SERVICE MANUAL

Model 330

Model 340 SC

Model 370 SC

Hughes-JVC Technology Corporation
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DECLARATION OF CONFORMITY

PER ISO/IEC GUIDE 22 AND EN 45014

Manufacturer: **Hughes-JVC Technology Corporation**
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Carlsbad, CA 92009-1504
USA

Hughes-JVC declares that this product conforms to the following Product Specifications (Directive/Standard):

Safety: EN 60950
IEC 950 (1992)

EMC: EN 55022 (1988) / CISPR-22 (1986) Class "A"
EN 50082-1 (1992) / IEC 801-2 (1991)
EN 50082-1 (1992) / IEC 801-3 (1984)
EN 50082-1 (1992) / IEC 801-4 (1988)
ANSI C63.4-1992, FCC, Part 15, Class A

In addition, the above product complies with the requirements of the Low Voltage Directive 73/23 EEC and the EMC Directive 89/336/EEC.

105662 First Edition January 1998
Rev A September 1998

Hughes-JVC Technology Corporation is ISO 9001 Registered and Certified.

Confidential and proprietary information.

Safety Information

Introduction

Before operating or working on a Model 330, 340SC and 370SC Projector, especially with the cover off, please read this safety information section thoroughly. Procedures requiring the opening of the projector covers and/or contact with electrical components should be performed by qualified service personnel. Strictly adhere to all notes and warnings.

Safety Equipment

Safety equipment specified in the Hughes-JVC Series 300 Projector Service and Operator's Training Course and certification program or equivalent should be used for maintenance of the equipment.

Warnings and Cautions

Warnings and Cautions

Warnings and Cautions in this manual should be read thoroughly and strictly adhered to. Warning and Caution symbols and definitions are as follows:

WARNING!!! Warns user of a potential electric shock hazard and/or specific procedure or situation that could result in personal injury if improperly performed.

CAUTION! Warns user of a potential safety hazard or potential light hazards that could cause severe eye injury or a specific procedure or situation that could result in damage to the equipment if improperly used.

The following important safety instructions are designed to insure your safety and the long life of your projector. Be sure to read these safety instructions thoroughly and adhere to all warnings given below.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received including interference that may cause undesired operation.

Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their own expense.

Shielded interconnect cables must be used with this equipment to insure compliance with the pertinent RF emission limits governing this device.

Installation Safeguards

WARNING!!! If there is any visible damage to any of the cables *do not* power on the projector until the damaged cable is replaced.

CAUTION! Place the projector on a smooth, stable and level surface in an area free from dust and moisture. Do not place the equipment in direct sunlight or near heat-radiating appliances. Smoke, steam and exposure to direct sunlight could adversely affect the internal components. Avoid rough handling when moving your equipment, as a strong shock could damage its internal components.

CAUTION! If installing a ceiling mount, use only parts supplied or recommended by the manufacturer. Observe all instructions and warnings as listed in this manual.

Projector Weight

The HJT projector and shipping container have a combined weight of either 512 (Model 330 and 340SC) or 550 (Model 370SC) pounds. The HJT shipping container weighs 170 pounds and the projector itself weighs either 342 (Model 330 and 340SC) or 380 (Model 370SC) pounds.

Do Not Tilt the Projector More Than 85 Degrees

Do not mount the projector on an excessively tilted base. The projector can be tilted a maximum of 85 degrees. Mount it only on a stable, vibration-resistant base capable of supporting at least three times its weight. If in doubt, contact the factory.

Avoid Projector Angles of 15° to 23°

Due to voids in the prism fluid there is a dead zone of 19° ± 4°. For this reason, avoid projector angles of 15° to 23°.

Maximum Projector to Screen Angle is 15°

The maximum vertical tilt angle from projector to screen is 15°. This is the maximum amount of keystone correction that is possible.

Heat Safeguards

Fans

The projector has multiple fans (exact number varies with projector model number) to cool the projector system. **Do not block the intake or outflow of any of the fans.** Intense heat is emitted within the system and must be properly dissipated in order to keep the system running properly.

CAUTION! Do Not Block Ventilation. Blocking air intake or exhaust ports can lead to projector overheating. Do not enclose the unit in a restricted space. Refer to the appropriate *Operator's Manual* for physical access and thermal clearance and for specific clearances needed for heat dissipation. Allow at least ten (10) minutes for projector cool down before removing power.

CAUTION! Do not unplug the power cord until after the arc lamp fan has stopped running. This fan protects the arc lamp from overheating.

Light Safeguards

Ultra Violet and Infrared Light

Eye/face protection is required from ultra violet light and infrared light in accordance with the following conditions:

1. X3 (up to 375 nanometers) shade goggles must be worn by anyone near the projector when the lamp is lit and the cover is off.
2. X5 (375 to 700 nanometers) shade goggles when actually working on the projector near the arc lamp source.

WARNING!!! High temperature, ultraviolet and infrared light. Refer all service to factory authorized personnel.

Ultraviolet radiation, dangerous glare, and high internal gas pressure is present at the Xenon Arc Lamp. It is contained in a protective reflector housing module.

DO NOT operate the Xenon Arc Lamp outside its intended standard housing or outside of the projector.

When replacement is required, the arc lamp must be replaced as an entire module as outlined in the Hughes-JVC *Model 330, 340SC and 370SC Projector Service Manual*.

No attempt should ever be made to replace the arc lamp inside its module!

The arc lamp produces dangerous intense light with hazardous levels of ultraviolet and infrared radiation. It operates at high temperatures (180ºC, maximum 300º C or over 500º F).

Do not touch the xenon arc lamp or any connections when the lamp is ignited or is arcing.

WARNING!!! BRIGHT LIGHT! Never look directly at the Arc Lamp, the lighted Projection Lens, or into the lamp housing, from any distance, when the projector is ON and light is projected. Direct exposure to light of this brightness can cause severe eye injury.

WARNING!!! High voltage access and safety interlock. Defeat restricted to factory authorized service personnel!

WARNING!!! High voltage points up to 40,000 volts are exposed inside the covers. Allow at least one minute to bleed off high voltage even after the unit has been turned off.

Due to high voltage danger, **DO NOT TOUCH:**

- White cables to CRTs—these cables can cause severe shock from a tiny, invisible crack or hole and should never be touched while projector power is on.
- CRT anodes—underneath the CRTs.
- Main power +/- supply posts—if shorted with metal objects,
- 80 amps can flow across the terminals.

- CRT yoke assemblies and other proximity electrical assemblies, components and wiring—if performing the yoke rotation or width adjustment (outlined in Section 3.2), always use an
- ANSI/ASTM 10,000 volt rated safety glove.
- Periodically check the condition of safety gloves for cracks.
- Arc Lamp main power ± posts.

Power Supply

The projectors operate from power sources indicated in the table below. Verify that local power source matches these requirements before operation!

Projector Power Supplies

Power	330	340SC	370SC
AC	200-240V	200-240V	200-240V
Current	20	20	30
Hz	50-60	50-60	50-60
Watts	2,700	3,325	4,550

Handle the power cord carefully and avoid excessive bending.
A damaged cord may cause electric shock or fire. For continued safe and reliable operation, only use cables supplied by the manufacturer for power and signal connections.

Installation should be performed by an electrician with current knowledge of electrical codes in the country of use.

Fluid Safeguards

Certain components of the projector contain fluid. If any fluid from the projector contacts the skin, wash off with soap and water. If any fluid from the projector splashes into the eyes, rinse with cool running water.

Ventilation and Foreign Object Retrieval

Ensure the projector's multiple fans are free from obstructions and operating properly. Air filters are located at vent ports on the cover. Air filters require periodic cleaning to ensure adequate cooling of the projector (see Section 4.3). Verify that vent ports are clear of all obstructions.

Keep the projector free from foreign objects, such as hairpins, nails, paper, etc. Do not attempt to retrieve such objects yourself or insert metal objects such as wire and screwdrivers inside the unit. If an object falls inside the projector, unplug the projector immediately and call a Hughes-JVC certified technician for removal.

WARNING!!! Various procedures in this manual involve the removal and replacement of system subassemblies. Ensure that the projector AC power plug is removed from the AC outlet **prior** to attempting any of these procedures.

1.0 Introduction

This Model 330, 340SC and 370SC Service Manual combines three (3) similar projector models into one (1) reference book, and should be used in conjunction with the appropriate projector Operator's Manual. This manual provides more detailed information on troubleshooting and maintaining the projectors and a more in-depth functional description of the system subassemblies than the specific Operator's Manual, which cover the specific projector system description, installation, adjustments, operation, maintenance, specifications, troubleshooting guide, and parts list.

The areas covered in this Service Manual include any similarities and differences of functional descriptions of Model 330, 340SC and 370SC projector electronics, service adjustments, maintenance (removal and replacement of subassemblies), and troubleshooting.

1.1 Acronyms Used In Manual

ALPS	Arc Lamp Power Supply
CH	Channel
CPU	Central Processing Unit
CRT	Cathode Ray Tube
DSP	Digital Signal Processor
EPROM	Erasable Programmable Read-Only Memory
F to V	Frequency to Voltage
G2	CRT Grid 2
HDB	Horizontal Deflection Board
HDTV	High Definition Television
HSYNC	Horizontal Sync
HVPS	High Voltage Power Supply
ILA®	Image Light Amplifier
I/O	Input/Output
I/R	Infrared
kHz	Kilohertz
LED	Light Emitting Diode
LVPS	Low Voltage Power Supply
NTSC	National Television Standards Committee
PCB	Printed Circuit Board
PLL	Phase Lock Loop
PLUGE	Picture Line-Up Generating Equipment
RAM	Random Access Memory
RGB	Red, Green and Blue
ROM	Read Only Memory

RTG	Raster Timing Generator
SCB	System Control Board
SPS	System Power Supply
TTL	Transistor-Transistor Logic
VAB	Video Amplifier Board
VCO	Voltage Controlled Oscillator
VDB	Vertical Deflection Board
VIN	Video Input
VPB	Video Processor PCB
VSYNC	Vertical Sync
VTR	Video Tape Recorder

1.2 Safety

High voltages and high intensity light sources exist in the Model 330, 340SC and 370SC Projector Systems and power supplies. Prior to performing any procedures, adjustments or maintenance review the chapter on Safety Information at the front of this manual.

1.3 Updates

This manual will be updated with information provided by *Service Bulletins* and manual supplements whenever necessary.

1.4 Hardware Compatibility

The table below lists part numbers currently compatible between the Model 330, 340SC and 370SC projectors, and those parts that are different in each.

Table 1-1 Hardware Compatibility

Printed Circuit Boards	330	340SC	370SC
DIFFERENT		**PART NUMBERS**	
Lamp Assembly	900611S	104651	104120
Ignitor	102083	102207	104475
System Power Supply	104070	104071	104038
High Voltage Power Supply	100562	100562	103769
SAME			
Raster Timing Generator	100568	100568	100568
Horizontal Deflection Board	102523	102523	102523
Vertical Deflection Board	102521	102521	102521
Video Processing Board	104672	104672	104672

Printed Circuit Boards	**330**	**340SC**	**370SC**
Video Amplifier Board	103774	103774	103774
System Controller Board	104668	104668	104668

Table 1-2 Projector Model Comparisons

330 Model	**340SC Model**	**370SC Model**
Different		
3,000 lumens	4,200 lumens	6,800 lumens
2,500 ANSI lumens	3,700 ANSI lumens	6,000 ANSI lumens
220V AC, 20A, 60Hz	220V AC, 20A, 60Hz	220V AC, 30A, 60Hz
2,700 Watts power	3,325 Watts power	4,550 Watts power
1,500 W Xenon arc lamp	2,000 W Xenon arc lamp	3,000 W Xenon arc lamp
Same		
5.2.1 software	5.2.1 software	5.2.1 software
graphics enhancement	graphics enhancement	graphics enhancement
30 memories	30 memories	30 memories
decoder board option	decoder board option	decoder board option

2.0 Functional Descriptions

Contents

This chapter provides functional descriptions of the major assemblies in the Model 330, 340SC and 370SC projectors.

Emphasis is placed on a description of system components to the functional block level. A number of block diagrams are provided for user reference.

Figure 2-1 provides a block diagram overview of the HJT Model 330, 340SC and 370SC projectors. For simplicity, each major electronics assembly is shown with signal paths between appropriate functional units. Major physical and electronics assemblies will be described in more detail in the following sections of this chapter.

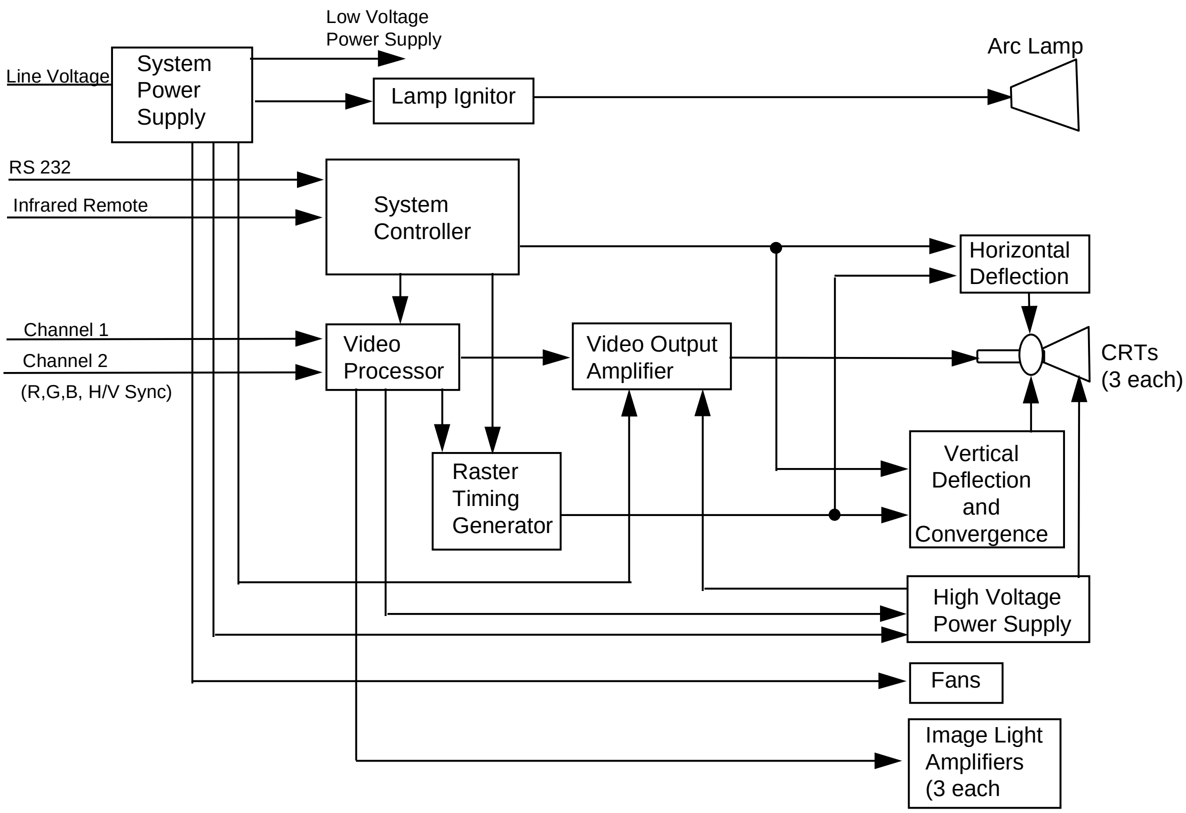


Figure 2-1 Model 330, 340SC and 370SC System Block Diagrams

2.1 Cover and Base

CAUTION! The covers for the HJT Model 330, 340SC and 370SC projectors must be installed for proper operation. Operation of the projector, other than for maintenance, with the covers removed is not recommended and will void the projector warranty.

In addition to aesthetics, the covers on the Model 330, 340SC and 370SC projectors serve several functions. The covers are an integral part of the cooling system of the projector. Air intake filters are contained in the covers as are cooling fans. The covers provide the operator and audience with protection from the extremely bright light produced in the projector. The covers also serve to reduce the noise generated by operation of the projector. The UL approval is only valid with the covers installed since they provide the primary protection to prevent personnel from coming into contact with the high voltages and currents contained within the projector.

WARNING!!! The HJT Model 330, 340SC and 370SC projectors use high voltages and high currents. Operation with covers removed exposes personnel to these dangerous conditions and may result in serious injury or death. No user-serviceable parts are contained within the projector. Refer all maintenance to only factory authorized and trained technicians.

The projector cover is a two-piece molded assembly. It is fastened to the projector frame by six (6) screws: two (2) on the rear cover; and four (4) on the front cover.

The fan intake side of the cover (right side) has filters on the intake vents. Periodic cleaning of the filters is required and should be performed in accordance with the procedure in this manual (Section 4.3). To avoid overheating the projector, ensure that the cover vent ports are free of obstructions at all times and that an adequate supply of fresh air is provided to the projector during operation.

2.2 External Power Requirements

The projectors require 208V to 240V, 50 Hz to 60 Hz, single-phase AC power. The units are equipped with an attached AC power cord and 3-prong twist lock plug (Model 330 and 340SC use Hubble Model 2323; Model 370SC uses Hubble Model 2623 or equivalent).

CAUTION! Operation at voltages and frequencies outside of these listed parameters may cause damage to the projector and will void the warranty.

2.3 Electronics Systems Overview

The objective of this portion is to provide a good general understanding of the projector electronics. The understanding gained will enable service personnel to more effectively maintain the projector to produce the desired result—*a great picture on the screen* —and quality you can see.

The Electronics Systems portion of this manual is based on block diagrams. The diagrams used have been drawn with two purposes in mind. First, they are general enough to be able to gain an understanding of the overall function of the various components of the system. Second, the block diagrams contain enough detail to make them valuable as a troubleshooting tool should the need arise. Schematics are not used but, where necessary, simplified circuitry is shown to aid in understanding the capabilities and/or limitations of the system. Discussion of troubleshooting is included but is largely confined to symptoms and identification of failed assemblies.

The Hughes-JVC Model 330, 340SC and 370SC projectors are multi-sync projectors capable of data, graphics, and display from 15KHz to 90KHz horizontal and 45Hz to 120Hz vertical. The projected image is continuously variable from 6 ft to 60 ft over throw distances (varies by projector model) from 10 ft to over 360 ft. All HJT Series 300 projectors are capable of keystone, pincushion, and linearity correction. The projectors feature digital control of functions, including convergence, picture adjustments, switching and diagnostics. In addition, the projector provides the ability to control the relative brightness anywhere on the screen.

The capabilities of the Model 330, 340SC and 370SC projectors are provided by a sophisticated electronics system, which consists of power supplies, input/output devices, and various circuit boards, and using both analog and digital components to provide functionality with a simple user interface. The electronics systems are assembled in modular fashion for ease of removal or maintenance.

The Model 330, 340SC and 370SC Electronics System consists of:

System Controller Board;

Video Processor Board;

Video Amplifier Boards (3);

Raster Timing Generator Board;

Horizontal Deflection Board;

Vertical Deflection Board;

Lamp Ignitor;

System Power Supply;

High Voltage Power Supply.

There are also image and sync signal inputs, an LED display, two (2) RS-232 communication ports, and two (2) IR receivers for projector control.

The digital and analog circuits of the System Controller Board direct the operation of image and raster generation circuits as well as controlling the input/output and power supply operation of the HJT Model 330, 340SC and 370SC projector electronics systems.

The System Controller sets operating parameters of the system such as brightness and contrast, produces internal test patterns and generates on-screen overlays, and sets the timing for the raster generation to adjust phase, geometric corrections, uniformity corrections and convergence. The System Controller houses the program memory as well as the memory for all convergence and uniformity maps, and has the responsibility of controlling communication with the user, power to the other areas of the projector, and other necessary functions.

The Video Processor and Video Amplifiers select the desired input signal and process it to produce the CRT beam modulation necessary to produce an image on the raster.

The Raster Timing Generator provides timing signals to the System Controller Board, selects the appropriate incoming sync signal and produces the timing signals for controlling the geometry of the raster.

The Vertical and Horizontal Deflection Boards produce their respective sweep currents to drive the deflection yokes. The Vertical Deflection Board also houses the convergence amplifiers that drive correction coils.

The System Power Supply provides all DC power below 200V to the projector. This includes the supply to the arc lamp/ignitor and the supply to the High Voltage Power Supply.

The High Voltage Power Supply provides all voltages of 200V and higher. This includes all CRT bias voltages except the cathode.

Image and sync inputs arrive in the projector at the Video Processor Board. Inclusion of the Decoder Board is optional. User communication is accomplished by on-screen displays, LED display output, IR remote input, or RS232 Input/Output. All of these devices are separate from, but communicate directly with the System Controller Board.

The detailed functional description of the subassemblies are covered below in the following order:

1. System Power.
2. Card Cage and Circuit Boards.
3. CRT Assembly.
4. Arc Lamp.

2.4 System Power

System Power Supply

The System Power Supply provides the connection between the external power source and the projector. The System Power Supply provides all internal DC power to the projector with the exception of that provided by the High Voltage Power Supply (Section 2.4.3). This includes the low voltage power to the electronics, the supply power to the HVPS, and the Arc Lamp power.

The System Power Supply is a AC-DC power supply with an input rectifier and protection circuit and several separate switchers; one (1) for Arc Lamp power, one (1) for +5V Standby power, one (1) for +24V Standby power, and others for the other low voltages.

All of the power supply outputs are protected against overvoltage and overcurrent. Overcurrent protection is a foldback circuit that limits the output current by reducing the output voltage when an overcurrent condition is detected. An overvoltage condition at the output of the supply will cause the affected voltage to be shut down until input power is removed and reapplied.

All of the SPS output voltages except Arc Lamp power are indicated by a LED display (see). The LEDs are located on a bar-type display on the backplane at the left side of the card cage. The individual LEDs will be lit when the corresponding voltage is energized. The LEDs are wired to the SPS output power using only a current limiting resistor so when the LED is lit, it is an indication that there is a voltage present, not necessarily the correct voltage. To verify whether or not the voltage at the output is correct, a voltmeter must be used to probe the output connectors J500, J501, or J502.

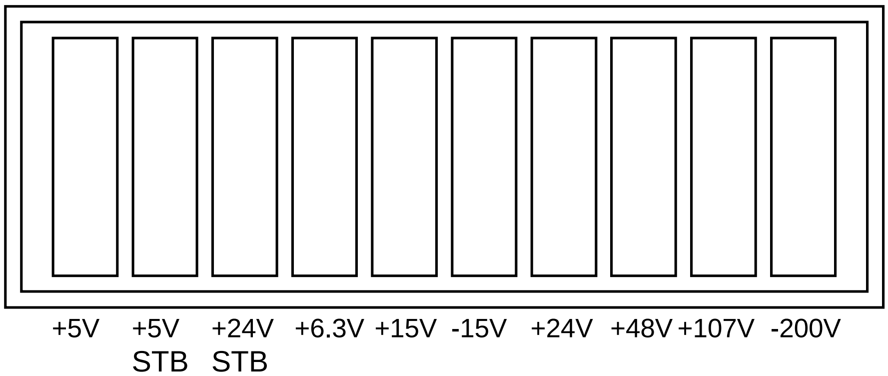


Figure 2-2 Backplane Status Indicators.

A safety interlock switch is located on top of the power supply. The interlock switch shuts off the System Power Supply whenever the cover is removed. During normal operation with the cover installed, the switch is in the 'armed' position. When the rear cover is removed, the switch will be released and cause power to the projector to be interrupted. To run the unit without the cover installed, override the interlock switch by pulling it up into the 'service' position. When the cover is replaced, the switch will automatically be reset into the 'armed' position.

A circuit breaker is located on the right side of the System Power Supply. The circuit breaker serves to remove all power from the projector (except for the power at the input terminals) by switching it to the OFF position.

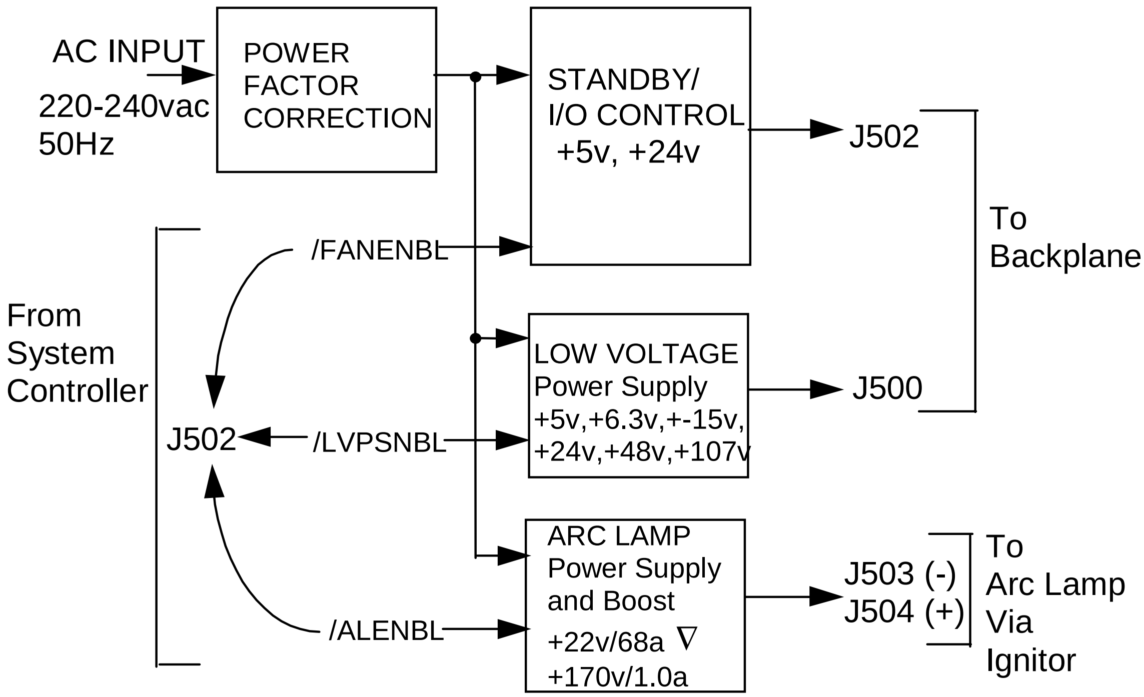
CAUTION! The circuit breaker must be switched off, and the projector must be disconnected from AC power prior to performance of any maintenance, to ensure that all power is removed from the internal components of the projector.

Normal operation of the System Power Supply is as follows:

When external power is applied, +5V Standby will always be energized as will the internal SPS fans. +24V Standby power for operating the fans will be energized whenever the lamp or electronics are turned-on and five (5) minutes after the projector is shut down.

All other voltages are controlled by the power-up or power-down commands issued by the operator.

The Arc Lamp power supply is a current-controlled supply with an open circuit voltage of about 170V. When the Arc Lamp is operating at steady state, the power supply provides the current set by the technician. The output of the supply has a large capacitor that will, on initial ignition of the Arc Lamp, provide the very high initial current necessary to ionize the xenon gas in the lamp and sustain the arc. The current setpoint is initially set at the factory and must be reset by the technician whenever an Arc Lamp is replaced.



∇ Model 330. Model 340SC = +25V/80a; Model 370SC = +30V/100a.

Figure 2-3 System Power Supply Block Diagram.

Normal system power-up (Electronics and Lamp):

1. Upon receipt of Power-On command, SCB pulls /FANENBL and /ALENBL lines low.
2. +24V Standby and Arc Lamp power supplies turn on.
3. When Arc Lamp lights (run voltage sensed by a window comparator in the SPS), SPS pulls /LAMPLIT line low.
4. When SCB senses /LAMPLIT low, SCB pulls /LVPSNBL line low.
5. Low voltage supplies turn on.
6. SCB senses +5V supply at correct level and enters normal program sequence.

Lamp only power-up:

1. Upon receipt of Lamp-On command, SCB pulls /FANENBL and /ALENBL lines low.

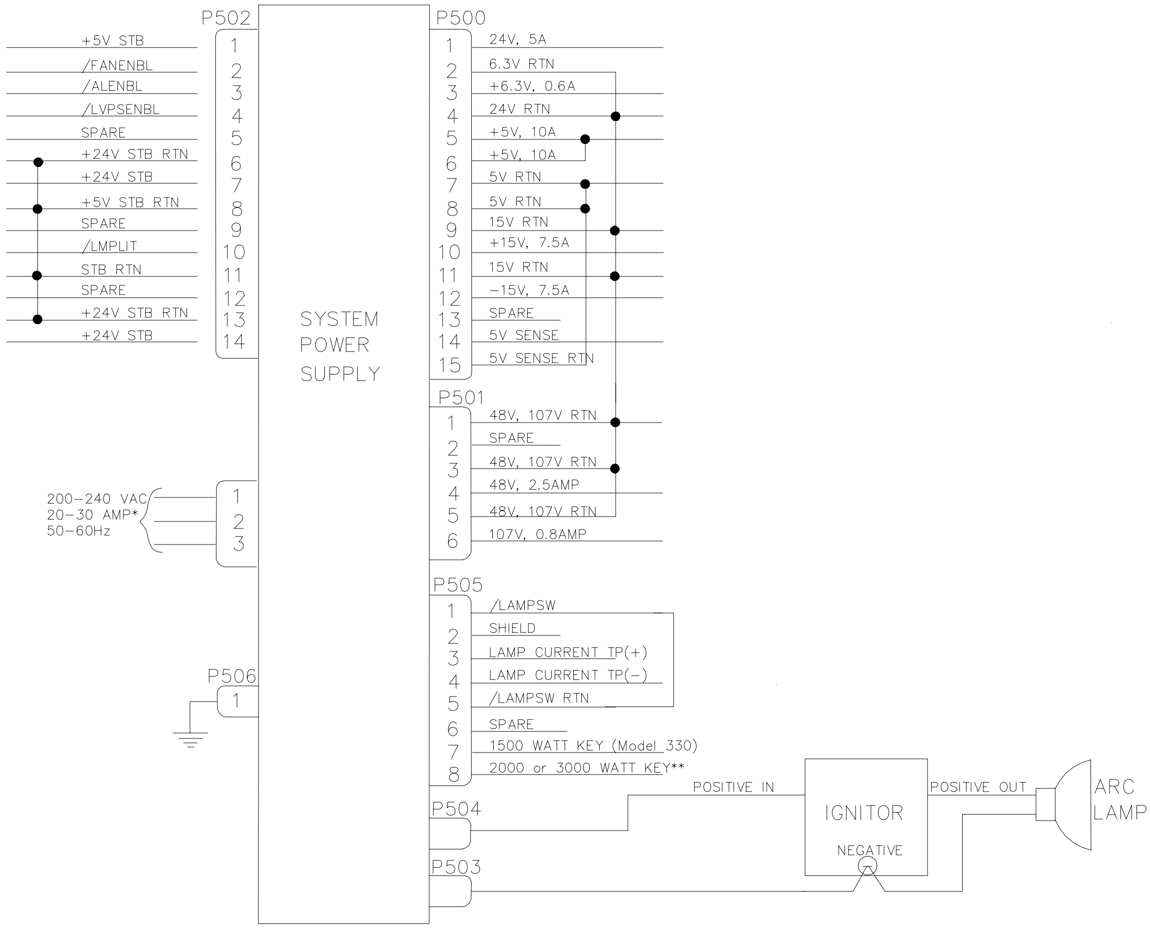
2. +24V Standby and Arc Lamp power supplies turn on.
3. When Arc Lamp lights (run voltage sensed by a window comparator in the SPS), SPS pulls /LAMPLIT line low.
4. SCB senses /LAMPLIT low and awaits further instructions.

Electronics only power-up:

1. Upon receipt of Electronics-On command, SCB pulls /FANENBL and /LVPSNBL lines low.
2. +24V Standby and Low voltage supplies turn on.
3. SCB senses +5V supply at correct level and enters normal program sequence, lamp can be turned on at any time.

Table 2-1 System Power Supply Voltage Distribution

Voltage	Fan	HV PS	CRT	SCB	HDB	VDB	VPB	RTG	VAB	Arc Lamp/ Ignitor
+5v										
+5v Stb										
+6.3v										
+15v										
-15v										
+24v										
+24v Stb										
+48v										
+107v										
+170v										



*Current depends on projector model (see Table 0-1 in Safety Chapter).
** Model 340SC = 2000 Watts; Model 370SC = 3000 Watts.

Figure 2-4 System Power Supply Input/Output Diagram

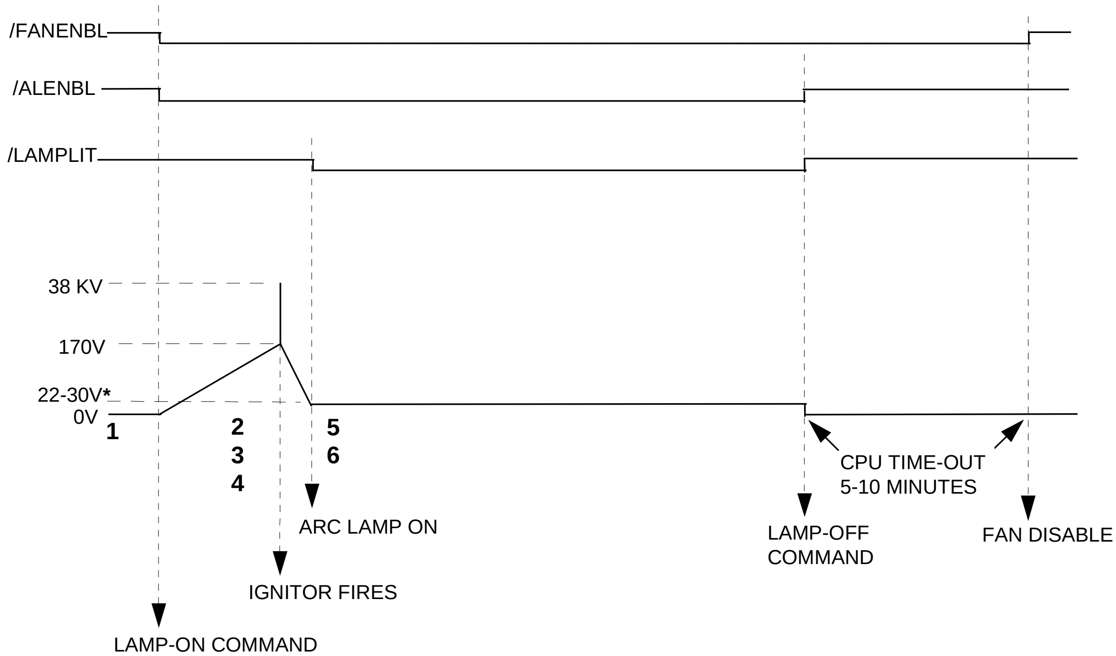
Arc Lamp Ignitor

The ignitor consists of a step-up power supply, a spark gap, and a transformer. The Arc Lamp Ignitor is mounted under or next to the Arc Lamp. It provides the high voltage pulse necessary to ignite the Xenon Arc Lamp that is the illumination supply for the HJT Model 330, 340SC and 370SC projectors.

The System Power Supply's Arc Lamp Supply section provides the necessary voltage to activate the ignitor and to sustain the arc in the Arc Lamp once it has been ignited. The SPS provides the power necessary to operate the ignitor.

The Ignitor is only active during the time between the Arc Lamp Power Supply energizing and the Arc Lamp igniting. During steady state operation and when the projector power is off, the ignitor is inactive.

When the Arc Lamp supply first turns on, it supplies 170V to the ignitor. The ignitor then senses this voltage, activates it's on-board supply, and produces a 1µS, 38KV pulse to the Arc Lamp. This pulse strikes an arc in the lamp. The Arc Lamp supply then provides the high current necessary to sustain the arc in the lamp. Refer to Figure 2-5 and the summary below for a description on the Arc Lamp and Ignitor timing.



***22-30V depending on projector model.**

Figure 2-5 Arc Lamp Ignitor Timing Diagram

Arc Lamp/Ignitor Timing Diagram Summary:

1. The operator powers Arc Lamp on. /ALENBL and /FANENBL from System Controller Board are pulled low. SPS receives /ALENBL from SCB and turns on the Arc Lamp PS.
2. Ignitor receives +170V boost voltage from the Arc Lamp PS.
3. Ignitor steps up the +170V boost voltage to a 1 µsec pulse, approximately 38KV.
4. Arc Lamp ignites from the 38kV pulse.
5. High current (about 68-100A depending on projector model) begins through Arc Lamp and voltage drops to +22-30V (depending on projector model).
6. /LAMPLIT signal goes to SCB to inform board that Arc Lamp is lit.

High Voltage Power Supply

The High Voltage Power Supply is a DC-DC converter (see Figures 2-6 and 2-7) and is located on the left side of the CRT housing. It provides all necessary voltages for the CRTs except the cathode drive, which comes from +107V from the SPS.

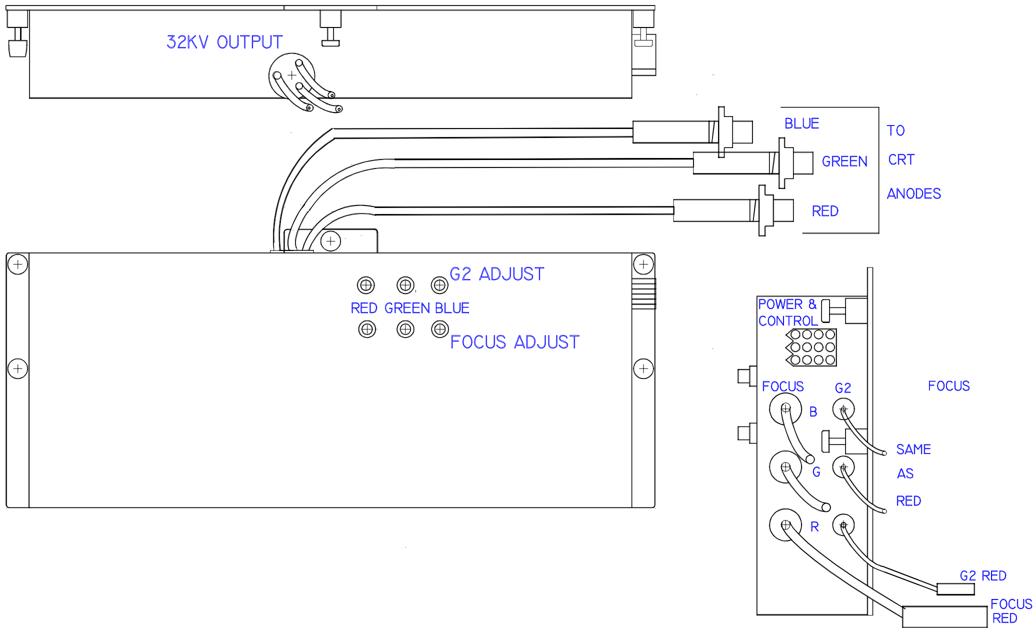


Figure 2-6 High Voltage Power Supply

Input power is +24V at 5A from the SPS. The input power is converted into the high voltage necessary to bias the CRTs.

The HVPS is controlled by an enable line (/HVEN) originating at the Video Processor Board. This enable line is controlled by logic that turns the HVPS off when there is a fault that could damage the CRTs. There are two (2) different conditions that could damage the HVPS:

1. If the +5V supply to the VPB is interrupted, the control and protection is compromised and the HVPS must be turned off.
2. If the cathode drive power is lost on one of the Video Amplifiers, the cathode current cannot be controlled and the HVPS is turned off.
3. Further details regarding this logic can be found in the functional description on the Video Processor Board in Section 2.6.4.

The HVPS provides several voltages to the CRTs:

Anode
Grid 1
Grid 2
Focus

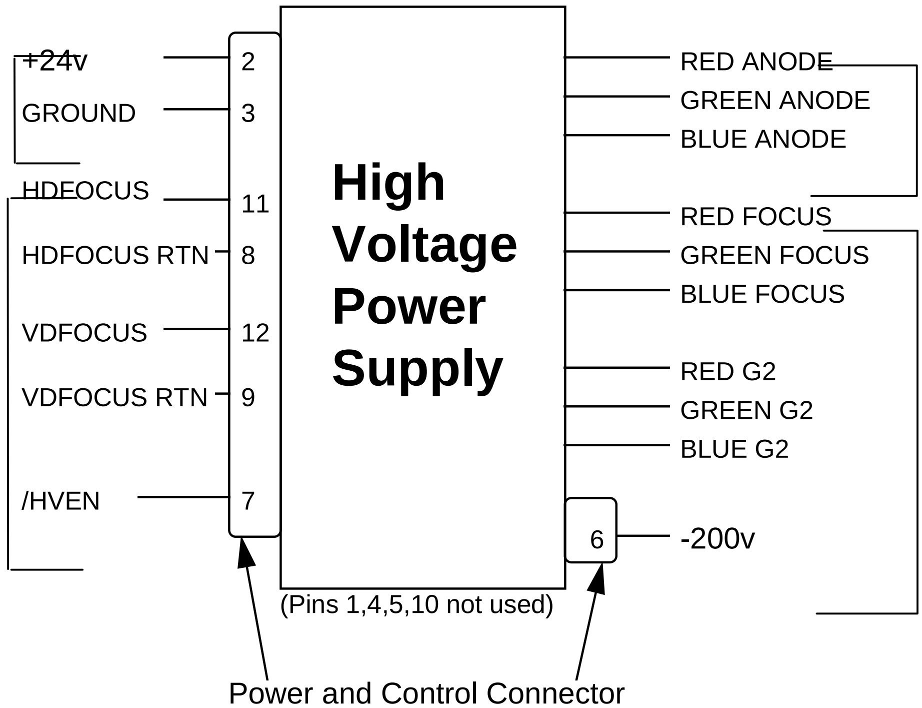


Figure 2-7 High Voltage Power Supply Input/Output Diagram

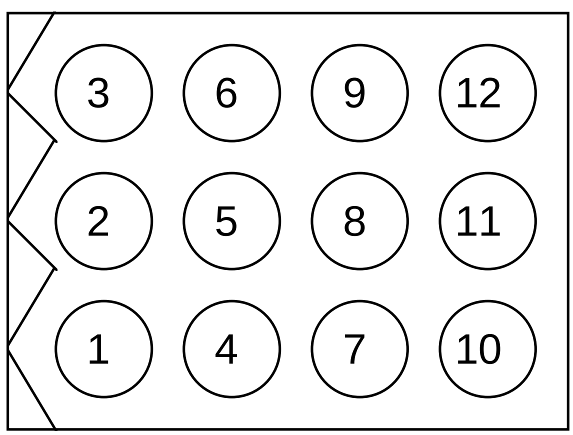


Figure 2-8 HVPS Power and Control Connector Jack, J603

CRT anode voltages are not user controllable. They are fixed at 32KV with a maximum output of 2.1mA total or 0.7mA per CRT. The anode voltage is the primary acceleration voltage for the CRT. Other bias voltages (screen grid, G2, and control grid, G1) are used to control the level of beam current. The anode voltage is routed out of the top of the HVPS, into the CRT housing to three (3) bulkhead connectors. From there, the anode wires on the CRTs route the anode voltage directly to the CRT. The anode voltages are overvoltage and overcurrent protected in the event of short circuits or CRT arcing.

Focus voltage (called Electronic Focus) is a modulated DC voltage. The DC level is set by the user during initial setup to focus the CRT electron beam. The Electronic Focus controls are located on the left side of the HVPS (see appropriate model *Operator's Manual*). There are three (one for each color) ¾ turn pots for adjusting the Electronic Focus. Of the six (6) pots found on the HVPS, the bottom three (3) are for focus while the top three (3) are for G2 adjustment (Section 3.10). The DC voltage is modulated within the HVPS using the HDFOCUS and VDFOCUS input signals. VDFOCUS is the vertical dynamic focus signal, which is a waveform with parabolic shape at the vertical sweep frequency. HDFOCUS is the horizontal dynamic focus signal. It is a combination of the vertical dynamic focus signal and a parabolic waveform at the horizontal sweep rate. These two (2) signals are combined in the HVPS to form a composite dynamic focus signal. Dynamic focus is necessary to ensure that the CRT electron beam is converged to a point as the beam sweeps across the CRT face. Since the CRT faceplate is flat, the raster sweep causes a varying path length for the electron beam. This means the focus voltage must be varied as the raster is traced. Focus voltage cannot be conveniently measured during normal operation.

G2 screen grid voltage is a DC voltage that is set by the user. The three (3) adjustment controls, one for each color, consist of ¾ turn pots and are located on the left side of the HVPS immediately above the focus controls. This voltage is set during initial projector setup to adjust the black level on the screen (see appropriate model *Operator's Manual*). The G2 voltage sets the bias on the screen grid of the CRT and is normally used to set the cutoff level. However, since the HJT light valve requires a non-zero input to produce a just-cut-off image on the screen, G2 is set to produce a slightly greater-than-black raster on the CRT. The G2 is adjustable from 100V to 1400V individually by color. The actual operating level will be near 1200V. G2 voltage cannot be conveniently measured during normal operation.

-200V is the supply to the control grid (G1) of the CRTs through the Video Amplifier Board. This voltage is not user controllable. The -200V is the only output voltage from the HVPS that goes to the backplane of the projector to be routed to the Video Amplifier, and uses the rear-most LED of the backplane LED bar for indication.

-200V is the only convenient means of directly observing whether or not the HVPS is turned on, either by observing the indicator LED on the backplane, or by probing the control connector with a voltmeter.

As with the other indicators on that LED bar, the LED is in series with current limiting resistor, so a lit LED indicates only the presence of a voltage, not necessarily the correct voltage.

The control grid, G1, voltage is regulated to -81V during normal operation. During blanking, G1 is pulled to -111V. When the CRTs are disabled for protection, G1 is pulled to its maximum negative level of -200V, which can be measured, at the control connector, pin 6.

2.5 Card Cage

The Card Cage provides support and protection for five (5) circuit boards, the Phase Locked Loop and the optional Decoder Board in the HJT Model 330, 340SC and 370SC projectors. The five-(5) circuit boards are, from rear to front, the VPB, RTG, SCB, VDB, and HDB. Each circuit board has it's own keyed slot. A circuit board cannot easily be plugged into the wrong slot since the connectors will not match up.

Horizontal Deflection Board	(HDB)	P/N 102523
Vertical Deflection Board	(VDB)	P/N 102521
System Controller Board	(SCB)	P/N 104668
Raster Timing Generator and Phase Locked Loop	(RTG) (PLL)	P/N 100568
Video Processor Board and optional Decoder Board	(VPB)	P/N 104672

Figure 2-9 Electronics Card Cage

Four (4) fans on the right side of the card cage cool the circuit cards in the card cage. These fans are energized by the +24V standby power from the SPS. They start when either the Arc Lamp or the electronics are powered up and run for approximately five (5) minutes after the projector is shut down.

The five-(5) cards in the card cage are held into position by both the friction of the connectors and by a circuit board retaining bar. The circuit board retaining bar should always be installed during projector operation.

A lightweight top cover is included with the card cage. Eight (8) screws secure the cover. The cover provides for direction of air flow and for physical protection of the circuit cards contained in the card cage. The cover should always be installed when the projector is in operation to ensure adequate cooling of the circuit cards and to prevent foreign materials from falling into the electronics.

The card cage is hinged in the rear to allow it to be folded backward for access to the CRT housing (when folding the card cage backward be sure that nothing is plugged into the rear electronic jacks or the plugs could be severely damaged). During normal operation, the card cage should be in its upright position to ensure proper cooling of the CRT enclosure.

A holddown screw is provided to secure the card cage and prevent it from rotating backward during shipping or when the projector is mounted in an upward-pointing position. The holddown screw is located on the lower, front, right corner of the card cage.

The rear panel of the card cage provides mounting for the projector controls. The VPB, which receives all image and sync inputs, is secured to the rear panel by four screws. The RS-232 control connectors and the IR receiver and repeater inputs as well as the LED dot matrix status display are located on the lower left of the rear panel. The projector model and serial numbers are also found on the rear panel.

2.6 Circuit Boards

The Model 330, 340SC and 370SC projectors have a total of twelve (12) accessible circuit boards. Seven (7) boards are located within the card cage (Figure 2-9) and five (5) are located outside the card cage (Table 2-2).

Table 2-2 Circuit Boards Outside Card Cage

No.	Description	330	340SC	370SC
1	Ignitor	102083	102207	104475
3	Video Amp Boards (VABS)	103567	103567	103567
1	Backplane	100571	100571	100571

Each circuit board can be replaced individually except the Backplane board and the PLL. The PLL is replaced with the RTG as a unit. The Ignitor was previously described in Section 2.4.2. The circuit boards covered in this Section are listed in Table 2-3.

Table 2-3 Circuit Boards

Page	Circuit Board		P/N	
2-18	Raster Timing Generator	(RTG)	100568	and PLL
2-26	Horizontal Deflection Board	(HDB)	102523	
2-34	Vertical Deflection Board	(VDB)	102521	
2-44	Video Processor Board and optional Decoder Board	(VPB)	104672	
2-55	Video Amplifier Board	(VAB)	103567	
2-58	System Controller Board	(SCB)	104668	
2-70	Backplane Board		100571	

Figure 2-10 on the following page provides an overall view of how the raster is produced. Details on the individual PCBs are provided in separate sections in this chapter.

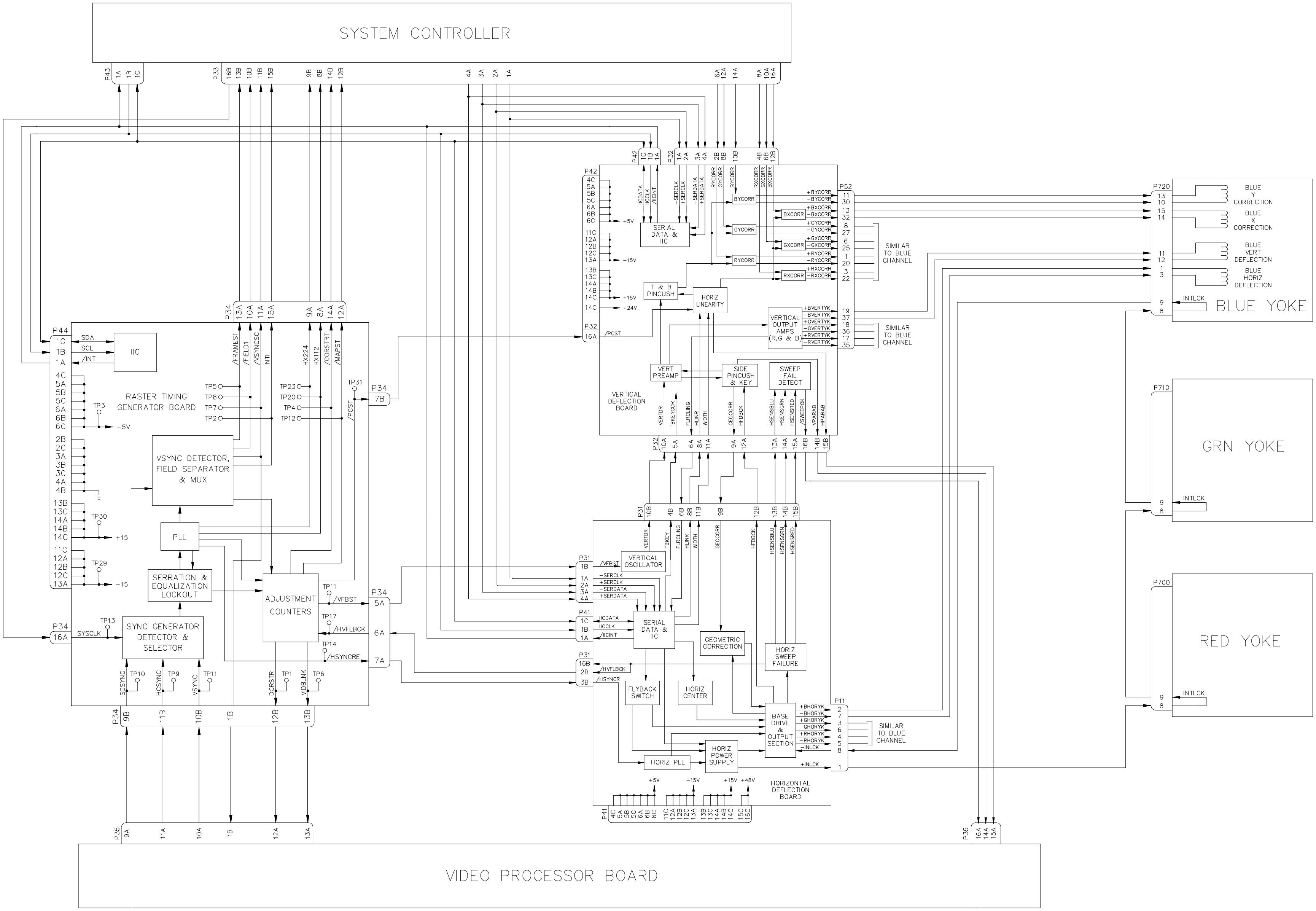


Figure 2-10 Raster Generation Block Diagram

Raster Timing Generator Board (RTG) p/n 100568

The Raster Timing Generator board is located in the electronics card cage and plugs into the backplane. It is the second board from the rear of the card cage and consists of a main board and the PLL daughter board (*see Figure 2-11*). The PLL board must be installed for the projector to operate.

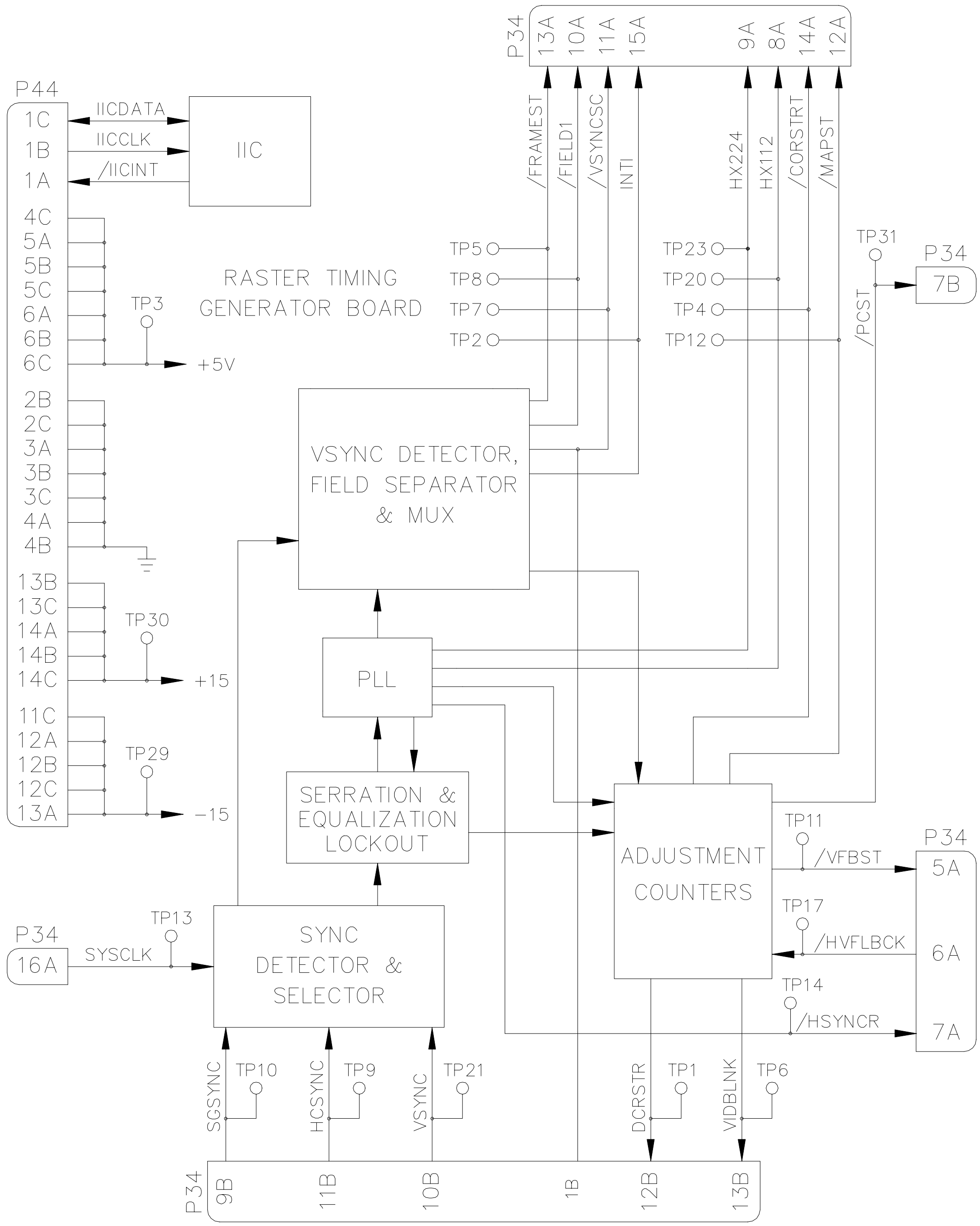


Figure 2-11 Raster Timing Generator Block Diagram

The following functions are provided by the RTG:

Internal sync generation.

Sync detection and selection.

Serration and equalization pulse removal.

Timing clock pulse generation.

VSYNC separation and field detection.

Timing for several geometry and correction functions.

Serial communication with the SCB.

The block diagram (*see Figure 2-11*) description, along with the I/O description in the Section following, provide information for module-level troubleshooting.

Sync Generator

The sync generator takes its input from the System Controller Board. The SCB provides a 4MHz clock signal, SYSCLK, which is used to generate a HDTV-like sync signal. The internal sync signal generated is a 33.33KHz horizontal, 59.3Hz vertical, interlaced signal. Because simply counting down from the 4MHz clock generates it, the actual signal that is produced is a square wave signal. The square wave does not affect normal operation of the projector but will cause a vertical bar to be generated on the screen when the projector is operating on the internal sync with the DC restore timing set to BP or TL.

Sync Detector and Selector

The Sync Detector and Selector take inputs from the Video Processor Board. The VPB sends the three (3) sync signals, SGSYNC (sync on green), HCSYNC (horizontal or composite sync), and VSYNC (vertical sync only) of any polarity to the RTG. These are the sync signals that come from the external source and are what the projector will gen-lock to when they are available. The sync selector uses a pre-determined priority to determine which of these sync signals will be used, based on which signals are present at the input.

The pre-determined priority to determine which sync signals used is:

1. Separate H and V sync will be used if both are available on their respective sync inputs,
2. Composite sync on the HSYNC input will be used if available and no sync signal is present on the VSYNC input,
3. Composite sync on the green image input will be used if no coherent sync signal is available on the HSYNC input.

If no external sync signal is detected on the three (3) sync input lines, the RTG will send out a signal to the SCB via the IIC interface indicating that there is no sync present (/External Sync Detect). The SCB will then make a determination whether or not to command the RTG, via the IIC interface, to select internal sync (Internal Sync Forced).

The selected sync signal(s) is inverted, if necessary, to provide the negative-going sync signal needed by the downstream circuits.

Serration and Equalization Lockout

The Serration and Equalization Lockout takes a composite sync signal and removes any equalization and serration pulses from it. The Model 330, 340SC and 370SC projectors do not require these pulses to operate. Removal of the serration and equalization pulses provides a faster, more reliable response to the vertical sync and subsequent relock to horizontal sync. This circuit uses the 4xHsync clock that is generated in the PLL to delete any sync information present in the center portion of the incoming horizontal waveform.

Phase Locked Loop

The PLL receives horizontal sync stripped of the serration and equalization pulses from the Serration and Equalization Lockout circuit.

The Horizontal Sync signal is fed to horizontal frequency decoder which uses a frequency/voltage circuit to pre-tune the VCO of the PLL to ensure proper locking. The Horizontal Frequency Decoder also provides a count of the number of horizontal lines per frame. The H count is then sent via the IIC interface, to the SCB (HCOUNT). The SCB uses this information to set up the correction and overlay maps and to calculate the H frequency.

The PLL takes in the horizontal sync signal and generates a clock signal that is a square wave of 224 times the horizontal frequency. The PLL will perform this function over the entire range of horizontal frequencies, 15KHz to 90Khz. It will maintain that signal over the full period of the raster including the vertical sync pulse. Counters in the PLL circuit also provide clock signals with frequencies of Hx112, Hx4, Hx2, and Hx1. These clock signals are square wave signals and are phase-coherent with respect to the H sync signal. The Hx224, Hx112, and Hx1 signals are used on both the RTG and the SCB for timing of corrections and raster adjustment. The signals that go to the SCB are Hx224, Hx112 (clock signals), and /HSYNCR (regenerated HSync, a negative-going pulse signal that is timed to be on the leading edge of the Hx1 clock). The Hx4 and Hx2 clocks are used exclusively on board the RTG for sync detection and timing.

Control of phase noise is critical—jitter will translate into a "smearing" of the projected image. Therefore, if the PLL loses lock, the /Phase Lock signal is sent to the SCB via the IIC interface. The SCB then makes a decision based on that information.

VSYNC Detector, Field Separator, and Mux

The VSync detector uses the Hx2 clock signal to detect the vertical sync signal from the composite external sync signal that arrives on either the HSYNC input or the sync-on-green input.

The field separator determines whether or not the signal is interlaced and, if so, which field is currently being displayed. This information is sent to the SCB as the signals INTI (interlace indication, high if interlaced), /FIELD1 (low when the field number 1 is current), and /FRAMEST (indicates the beginning of a new frame).

The mux takes the external Vsync and field signals and multiplexes them with the internal sync signal to select which will be used. The multiplexed Vsync signal is pulse-shaped to be three (3) horizontal periods in length. This signal, /VSYNCSC (pulse-shaped vertical sync) is then sent to the SCB and the VPB.

Adjustment Counters

The adjustment counters implement the following timing functions:

- Left side, right side, top side, and bottom side blanking.
- Vertical and horizontal timing for convergence correction and overlay.
- Pincushion and linearity correction timing.
- Vertical phase.
- DC restore timing.

The four-(4) sides' blanking adjustments are accomplished by counting from the regenerated H and VSYNC signals respectively. Each adjustment is independent of the others. Vertical blanking is accomplished by counting a specified number of horizontal lines after the vertical sync signal out of the VSYNC Mux. The top blanking counts the commanded number of lines then unblanks the picture. The bottom blanking counts the commanded number of lines then blanks the image.

Horizontal blanking is accomplished by counting a specified number of Hx224 clock pulses after the regenerated HSYNC pulse, /HSYNCR). The left side blanking counts the commanded number of clock pulses then unblanks the image. The right blanking counts the commanded number of clock pulses then blanks the image. The outputs from these counters are combined with a signal indicating PLL lock, into a composite blanking signal VIDBLANK (high when the image is to be blanked) that is sent to the VPB. The user selects the actual position of the four sides' blanking by adjusting from the remote control.

The SCB calculates the number of clock pulses to count for each of the four sides based on the input from the user, and sends those numbers to the appropriate counters via the IIC serial communication bus signals LBlank, RBlank, TBlank, and BBlank.

Adjustment counters also generate the convergence correction and overlay address generators' timing signals. The correction bit-map address counter's MAPST (timing pulse to tell the correction and overlay address generators to start a new frame) timing pulse is generated by counting the commanded number of /HSYNCR pulses since the vertical deflection flyback start pulse. The /CORSTRT (signal that indicates to the SCB when to start the correction and overlay address generators counting) timing signal is a pulse signal sent to the SCB. Its timing is determined by counting the commanded number of Hx224 pulses after the /HSYNCR signal.

The position of the overlays (including menus and test patterns) and correction maps is controlled automatically in the vertical direction. In the horizontal direction, the user controls the position via the MENU POSITION selection under the TIMING SETUP MENU. This circuit also determines the phase between the regenerated HSYNC and the HV Flyback from Deflection. This value is read by the SCB over the IIC bus.

The pincushion and linearity correction timing signal is a pulse signal called /PCST that is sent to the Vertical Deflection Board. The signal is generated using the same timing method as the /CORSTRT signal but has a separate command from the SCB. It controls the timing of the top and bottom pincushion correction, top and bottom keystone correction, and horizontal linearity correction. The signal timing is selected by the user and controlled by the SCB. Adjusting PINCUSHION POSN under the TIMING SETUP MENU controls it.

Vertical phase adjustment is accomplished by timing the /VFBST (vertical start) signal with respect to the regenerated vertical sync signal. This signal is generated by counting a commanded number of horizontal lines after the vertical sync signal /VSYNCSC. The signal timing is selected by the user and controlled by the SCB. It is controlled by adjusting PHASE using the up/down arrows.

DC restore timing determines the point in time that the signal is clamped and the DC restore (Section 2.6.4, Video Processor Board) function is accomplished. The user has three (3) choices from which the DC restore timing can be selected. These are Backporch (BP), Tri-level (TL), and Sync-tip (ST). The choices are selected in the SL column of the CHANNEL LIST under the CHANNEL MENU (Figure 5-1, Menu Structure).

The DC restore timing counts a preset number of Hx224 clock pulses after the HSYNC signal leading edge. ST will clamp and DC restore during the time that the HSYNC pulse is active. ST clamping is timed with respect to the leading edge of the HSYNC pulse. It is seldom used but is necessary when there is no back porch to clamp on (image starts immediately after the sync pulse). BP will clamp and DC restore shortly after the HSYNC pulse. BP clamping is timed with respect to the trailing edge of the HSYNC pulse. The timing is calculated to be on the back porch of the signal (after the sync pulse but before the image begins). This is the most frequently used clamp timing.

The default setting for the DC restore timing is BP when a new channel is set up. TL clamping occurs significantly after the HSYNC pulse. The purpose of TL timing is to provide DC restore timing that is compatible with the Tri-level type sync used with HDTV signals. Like BP, TL clamping is timed with respect to the trailing edge of the HSYNC pulse. The output of the Synctip/Backporch circuit is a pulse signal (DCRSTR) going to the VPB.

Serial Communication

The RTG uses only the IIC bus for serial communication with the SCB (Section 2.6.6). The information transferred over the IIC bus is indicated below (I = input to RTG, O = output from RTG). A change in output data generates an interrupt pulse.

Table 2-4 IIC BUS Information

I/O	Information	Description
I	Priority Select	Commanded sync selection priority (always fixed as described above).
I	Vertical Flyback Start Delay	Commanded V phase.
I	Map Start Delay	Commanded timing for vertical positioning of correction map.
I	L Blank	Commanded position of left blanking.
I	R Blank	Commanded position of right blanking.

I	T Blank	Commanded position of top blanking.
I	B Blank	Commanded position of bottom blanking.
I	/STBP	Command for DC restore timing on either leading or trailing edge of sync pulse.
I	DC Restore Delay	Commanded timing of DC restore after reference edge of sync pulse.
I	Internal Sync Forced	Command to force internal sync select.
I	Correction Start Delay	Commanded H phase of correction map.
I	Pincushion Start Delay	Commanded H phase of pincushion, keystone, and linearity correction.
I	2H Sync Enable	Command determines path of H sync signal.
I	Shifted Sync Enable	Command determines path of H sync signal.
O	/External Sync Detect	Is an external sync available.
O	HCount	Count of H lines per frame.
O	/Phase Lock	Indication of PLL lock.
O	Phase Count	Indication of phase difference between HSYNC and HFlyback.

Raster Timing Generator I/O

This section provides a description of the inputs to and outputs from the RTG. The I/O description are arranged by the source/destination of the signal and so the assemblies communicated with are used as the primary heading of each group of signals and then are further subdivided into inputs and outputs. In each case, the signal's direction is noted, with input referring to an input *to* the RTG, and output to an output *from* the RTG. (e.g.: under System Controller Board “Input”; SYSCLK refers to the signal SYSCLK that is an *input* to the RTG from the System Controller Board). When test points are provided for the I/O they are noted.

Table 2-5 Raster Timing Generator I/O Signals

	System Controller Board
Inputs	**Description**
SYSCLK	4 MHz clock signal for derivation of internal HDTV sync signal. (TP 13)
IICCLK	IIC clock line. Unidirectional clock line for control of synchronous data transfer over IIC data bus.

Outputs	**Description**
/IICINT	IIC interrupt line. Signal line for slave boards to inform the SCB (master) that there is data to be transferred. Master then polls slaves to determine the source of the interrupt.
/Hx224	Square wave signal 224 X the horizontal frequency for overlay address generator clocking. (TP 23)

/Hx112	112 times the horizontal frequency for convergence and Z axis correction address generator clocking. (TP 20)
/CORSTRT	Signal used to start the convergence and overlay address generators during each horizontal sweep. (TP 4)
/FRAMEST	Indicates the beginning of a frame. Used in the SCB for counting vertical frequency. (TP 5)
INTI	Indicates when input source signal is interlaced. (TP 2)
/VSYNCSC	Regenerated vertical sync signal, pulse shaped to 3 horizontal lines in width. (TP 7)
/FIELD1	Low during field #1 of an interlaced input source. (TP 8)
/MAPST	Pulse signal to signal the overlay and correction address generators to reset for a new frame. (TP 12)

I/O	**Description**
IICDATA	IIC data line. Bi-directional serial line for synchronous data transfer between SCB and other circuit boards. See detailed description for list of signals transferred and data direction.

	Video Processor Board
Inputs	**Description**
SGSYNC	Stripped Green Sync is Sync-on-Green composite sync signal. (TP 10)
HCSYNC	Horizontal/Composite Sync. (TP 9)
VSYNC	Vertical Sync used only for separate H and V sync. (TP 21)

Outputs	**Description**
DCRSTR	Pulse for DC restore timed to correspond to ST, BP, or TL. (TP 1)
VIDBLNK	Signal for image blanking from adjustment counters. (TP 6)
/VSYNCSC	Vertical sync signal pulse for ILA bias sync. (TP 7)

	Horizontal Deflection Board
Inputs	**Description**
/HVFLBCK	Signal representing horizontal flyback from the HDB. Used for determining H phase. (TP 17)

Outputs	**Description**
/VFBST	Signal to start the vertical retrace. (TP 11)
/HSYNCRE	Selected HSYNC signal. (TP 14)

	Vertical Deflection Board
Outputs	**Description**
/PCST	Signal to time the start of T/B pincushion and linearity correction. (TP 31)

	System Power Supply
Inputs	**Description**
+15V	Power for the analog section of the RTG including the PLL. (TP 30)
-15V	Power for the analog section of the RTG including the PLL. (TP 29)
+5V	Power for the digital portions of the RTG. (TP 3)
AGND	Return for +/-15V, separated from DGND by an inductor.
DGND	Return for +5V, separated from AGND by an inductor.

Interlocks and Protection

This section describes the interactions between boards where one (1) board may cause others to perform protection functions.

Input

None

Output

If the PLL falls out of sync, a signal indicating an out-of-lock condition (/PLOCK) will be sent to the SCB.

Internal

When no external sync signal is present, the RTG will select it's internal sync signal, thus preventing the need to provide another source for overlay generation.

Horizontal Deflection Board P/N 102523 (HDB)

The horizontal deflection board plugs into the electronics card cage and is the forward-most card in the card cage.

The following functions are provided by the HDB:

- Drive main horizontal deflection coils to provide horizontal raster scan.
- Horizontal raster centering.
- Horizontal width adjustment.
- Side pincushion correction.
- L/R keystone correction.
- Horizontal sweep reversal.
- Horizontal phase adjustment.
- Oscillator for vertical deflection.

The block diagram (*see Figure 2-12*) description and the I/O description, in the section following, provide information to perform module level troubleshooting.

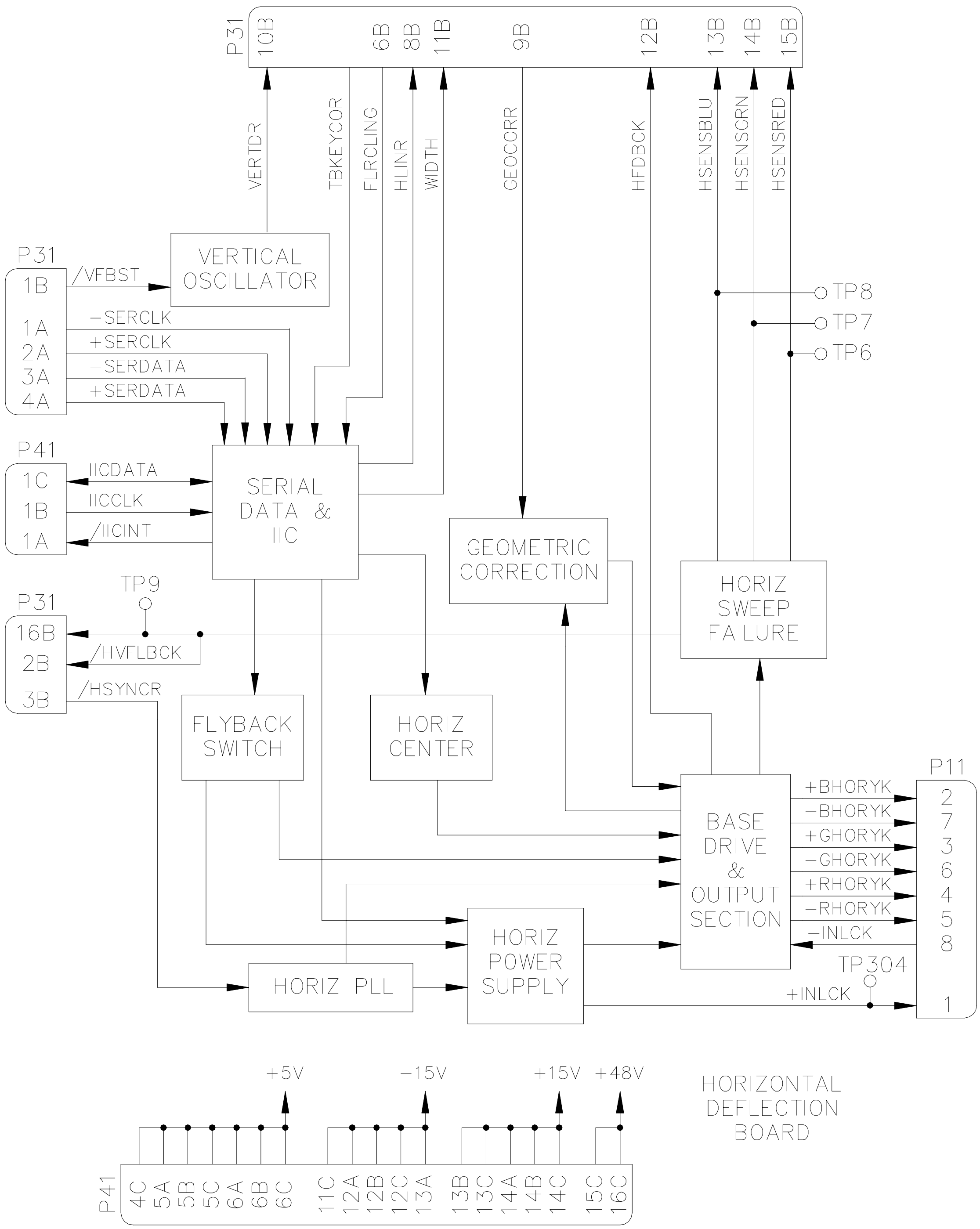


Figure 2-12 Horizontal Deflection Board Block Diagram

Vertical Oscillator

The function of the vertical oscillator is to lock to the vertical signal, /VFBST, sent by the RTG, and produce a pulsed output, VERTDR, of the same frequency. The /VFBST signal initially is sent to a Frequency to Voltage converter to provide a program voltage to the oscillator. This presets the oscillator frequency so the oscillator then is able to lock to the incoming vertical sync signal.

The purpose for having an oscillator for the vertical sweep circuit is to maintain a sweep even in the event of loss of vertical sync signal to prevent damage to the CRT. The vertical oscillator has a free-run frequency of approximately 35Hz when there is no input.

Horizontal Phase Locked Loop

The incoming signal, /HSYNCR initially is sent through a Frequency to Voltage converter. The output from the F to V is used to provide a program voltage to the PLL, set the horizontal phase adjustment range, and to set the frequency of the horizontal power supply. The Horizontal PLL, like the vertical oscillator, takes the input pulsed signal, /HSYNCR, from the RTG, locks to it, and produces a pulsed output of the same frequency. The Horizontal PLL has the additional function of controlling the phase of the output signal relative to the input signal. To do this, the horizontal PLL receives an input from the SCB via the serial bus that indicates the desired phase relationship. The incoming signal /HSYNCR is then compared with the flyback pulse (derived separately from the /HVFLBCK signal listed in the I/O section) to measure the phase relationship. To control horizontal phase, the operator presses the PHASE button on the remote control, then adjusts phase with the left and right arrow keys. As with the vertical oscillator, the Horizontal PLL provides for a minimum free-run frequency in the event of loss of horizontal sync signal. That frequency is approximately 12.5kHz.

Horizontal Centering

Horizontal centering of each raster (R, G, and B) is accomplished by applying a direct current bias to each horizontal deflection coil. The DC comes from a programmable current source that is in series with the main deflection coil. The current source is capable of providing either positive or negative polarity. Control input to the current sources comes from the SCB via the serial interface. Pressing the POS (Position) button on the remote control, then selecting the desired color can independently control the centering of each individual color. The left and right arrow keys are then pressed to adjust horizontal position. When controlling the position, Green is a master, i.e.: when Green is selected, all three-(3) colors move. Red and Blue are independent.

Horizontal Power Supply

The horizontal power supply is a switching power supply that provides an output voltage proportional to the horizontal frequency and width. The variable output of the power supply is a negative voltage providing a sink for the horizontal deflection current. The trace speed of the CRT spot will be determined by the voltage applied across the deflection coil. The voltage at the power supply output directly determines this in turn. So when the output from the power supply increases, a given width of raster can be obtained in a shorter period of time, thus supporting a higher horizontal frequency. In addition to providing for the maintenance of a constant raster size for varying frequency, a variable power supply is also necessary for control of the raster width. The output voltage of the horizontal power supply is controlled primarily by two (2) inputs.

The first is an input derived from the F to V in the horizontal PLL circuit. This presets the output of the supply to a voltage that will provide a nominal raster size for the horizontal frequency applied.

The second input is provided by the SCB via the serial interface. This input allows control of the raster width by the operator. To control the raster width, the operator presses the SIZE button on the remote control. Pressing the left and right arrow keys then controls the width. The three (3) rasters are not remotely controllable on an individual basis. They can however, be set individually with respect to each other by adjusting the cores of the variable inductors mounted on the yoke terminal boards (see appropriate model *Operator's Manual*).

Flyback Switching

Flyback switching, necessary to avoid overscan and excessive power consumption over the wide range of horizontal frequencies covered, is accomplished using relays. When the input source is changed, the relays are switched to change the response of the resonant flyback circuit. Since horizontal flyback necessarily causes very high voltages, the relays must not be switched while under load. When the SCB commands flyback switching to occur, the switching circuit sends a signal to the GRN Horizontal sweep failure circuit to turn off the CRT beams. It also sends a signal to the Horizontal Power Supply to turn it off and shut down the horizontal sweep. The relays are then switched and the sweep and CRT beams are allowed to return to normal. This sequence of events will occur each time the input source to the projector changes, regardless of any line rate changes. There are four frequency bands and flyback times that can be set. The frequency ranges and flyback times are: 6.6uS @ 15-25.1kHz, 4.1uS @ 25-33.1kHz, 2.9uS @ 33-60.1kHz, and 2.4uS @ 60-90kHz. Flyback switching is not manually controllable by the operator.

Geometric Correction

The HJT Model 330, 340SC and 370SC projectors provide the ability to obtain a rectangular raster when shooting off-axis in the vertical direction from the screen. This ability is provided by left/right keystone correction. A geometric correction signal, GEOCORR, for controlling both the L/R keystone correction and the L/R pincushion correction is obtained from the Vertical Deflection Board. The GEOCORR signal is a periodic signal composed of a parabolic summed with a ramp signal, both at the vertical frequency. This signal is used to vary the width of the horizontal sweep as the vertical sweep progresses. It does this by modulating the negative voltage applied to the power transistor, thereby modulating the horizontal width of the raster. The components of GEOCORR, pincushion correction and keystone correction, are individually controllable by the operator (see appropriate model Operator's Manuals).

Output Section

The horizontal sync pulse signal produced by the Horizontal PLL is applied to the output section to control the timing of the horizontal sweep. The output section includes the power output transistor, base drive circuit, reversing connectors, and interlock circuit.

The three (3) horizontal deflection coils (B, G, and R) are driven in parallel by a single drive circuit and transistor. This is the reason for the inability to remotely control the three (3) raster widths independently. Since the deflection coils are in parallel, it is imperative that they all be connected prior to applying sweep voltage—the interlock circuit ensures this. An output from the Horizontal Power Supply is sent, in series, through all three (3) yoke connectors. This is part of the bias voltage used to operate the base drive circuit for the output section. Thus, if any of the yoke connectors is not connected, the output transistor will not turn on, and no horizontal sweep will be present.

There are two (2) output jumpers on the board, J500 and J501. Their function is to reverse the direction of the current through the horizontal deflection coils for front and rear projection. The output cable shall be connected to J501 for rear projection and J500 for front projection (Jumper Settings, Section 3.9).

Horizontal Sweep Failure Detection

Protection of the CRT from spot burns is accomplished by never allowing the CRT to continue to have beam current when there is no deflection. To this end, the HDB has a sensing circuit that detects when there is a loss of sweep that may cause CRT damage. This circuit senses the horizontal flyback voltage and frequency. By sensing both amplitude and frequency, the projector is able to maintain sweep over the widely varying input conditions allowed and still protect the CRTs from damage. The flyback signal is AC coupled and peak detected, then compared with a reference. As long as the flyback amplitude and frequency are above the minimum allowed, the sweep detection outputs (HSENSBLU, HSENSGRN, and HSENSRED) are pulled high. These signals are sent to the VDB for processing.

Serial Communication

The HDB uses two (2) separate, interrelated serial data communication systems to communicate with the SCB; the IIC bus, and a differential, synchronous data bus. The information transferred over the serial busses is indicated below (I = input to HDB, O = output from HDB). Also noted is whether the information is transferred over the IIC or the serial bus. A change in output data generates an interrupt pulse.

Table 2-6 HDB Serial BUS Information

Bus	I/O	Information	Description
IIC	**I**	Flyback switch select	Two bits that select one of four flyback switching times (see detailed description)
IIC	**I**	Flyback switch pulse	Pulse signal that commands the flyback relays to switch.
IIC	**O**	Front/Rear indication	TTL level that indicates whether the projector is in front screen mode (high) or rear screen (pulled low).
IIC	**O**	Floor/Ceiling indication	TTL level that indicates whether the projector is in the upright mode (high) or inverted mode (pulled low).

Bus	I/O	Information	Description
IIC	**I**	Serial data load	Command to the serial data receiver that the incoming data is to be read.
Serial	**I**	HPHASE	Commanded horizontal phase of picture.
Serial	**I**	HLINR	Commanded amount of overall H linearity correction.
Serial	**I**	TBKEY	Commanded amount of top and bottom Keystone Correction.
Serial	**I**	HCENTBLU	Commanded horizontal position of blue raster.
Serial	**I**	HCENTGRN	Commanded horizontal position of green raster.
Serial	**I**	HCENTRED	Commanded horizontal position of red raster
Serial	**I**	WIDTH	Commanded width of raster

Horizontal Deflection Board I/O

This section provides a description of the inputs to and outputs from the HDB. The I/O description are arranged by the source/destination of the signal and so the assemblies communicated with are used as the primary heading of each group of signals and then are further subdivided into inputs and outputs. In each case, the signal's direction is noted, with input referring to an input *to* the RTG, and output to an output *from* the HDB. (e.g.: under Raster Timing Generator 'Input'; /VFBST refers to the signal /VFBST that is an *input* to the HDB from the Raster Timing Generator). When test points are provided for the I/O they are noted.

Table 2-7 Horizontal Deflection Board I/O Signals

	System Controller Board
Inputs	**Description**
IICCLK	IIC clock line. Unidirectional clock line for control of synchronous data transfer over IIC data bus.
+SERCLK	Serial data transfer clock (+). Unidirectional, differential clock line from SCB to other circuit boards. Used for synchronous control of serial communication over SERDATA data lines.
-SERCLK	Serial data transfer clock (-).
	System Controller Board
Inputs	**Description**
+SERDATA	Serial data transfer. Unidirectional, differential, synchronous serial data communication line. Used for transferring data from SCB to other circuit boards. Uses SERCLK and IIC for control of receiver.
-SERDATA	Serial data transfer

Outputs	Description
/IICINT	IIC interrupt line. Signal line for slave boards to inform the SCB (master) that there is data to be transferred. Master then polls slaves to determine the source of the interrupt.

I/O	Description

IICDATA	IIC data line. Bi-directional serial line for synchronous data transfer between SCB and other circuit boards. See detailed description for list of signals transferred and data direction.

	Raster Timing Generator
Inputs	**Description**
/VFBST	Signal to control the vertical oscillator frequency and retrace timing
/HSYNCR	Regenerated horizontal sync signal

Outputs	**Description**
/HVFLBCK	Pulse signal representing horizontal flyback used to determine phase of image

	Vertical Deflection Board
Inputs	**Description**
GEOCORR	Periodic signal for L/R keystone and L/R pincushion correction
FLRCLING	TTL level indicating whether or not raster is inverted

Outputs	**Description**
VERTDR	Pulse output from vertical oscillator.
HLINR	DC voltage controlling horizontal edge linearity correction
HFDBK	DC voltage proportional to the H power supply output voltage
WIDTH	DC voltage indicating commanded width.
TBKEYCOR	DC voltage representing commanded top and bottom keystone correction
HSENSRED	DC voltage, high when flyback pulse for red yoke is present at normal frequencies.
HSENSBLU	Similar to HSENSRED.
HSENSGRN	Similar to HSENSRED.

	Main Horizontal Deflection Coils
Inputs	**Description**
/INLCK	Return from series daisy-chain for sensing yoke connectors installed.

Outputs	**Description**
+INLCK	Negative voltage supply from the horizontal power supply to the daisy-chained yoke connector interlock.
+BHORYK	Positive supply from the centering current source to the blue horizontal main deflection coil.
-BHORYK	Return from the blue horizontal main deflection coil to the horizontal deflection power transistor.
+GHORYK	Similar to +BHORYK.
-GHORYK	Similar to -BHORYK.
+RHORYK	Similar to +BHORYK.
-RHORYK	Similar to -BHORYK.

	System Power Supply
Inputs	**Description**
+48V	Power for horizontal deflection
+15V	Power for the analog section of the HDB
-15V	Power for the analog section of the HDB
+5V	Power for the digital devices on the HDB
GND	Return for HDB

Interlocks and Protection

Input

None

Output

HSENSRED - Used to shut down the CRT beams in the event of horizontal sweep failure.

HSENSGRN - Identical to HSENSERED.

HSENSBLU - Identical to HSENSERED.

Internal

+INLCK

Prevents the horizontal output section from being turned on when 1 or more deflection coils not connected.

-INLCK

- Part of +INLCK circuit.
- Minimum Frequency on Oscillators and PLLs
- Ensures that there will be a sweep in both the horizontal and vertical directions when the sync pulse disappears. This is for protection of the CRT phosphor.

Vertical Deflection Board P/N 102521(VDB)

The Vertical Deflection Board plugs into the electronics card cage and is the second board from the front in the card cage.

The following functions are provided by the VDB:

Drive main vertical deflection coils to provide vertical raster scan for all three (3) CRTs.

Drive all correction coils to provide convergence and geometry correction.

Scan failure detection for all six main deflection circuits.

Vertical size adjustment.

Vertical linearity adjustment.

Vertical raster centering.

Top and bottom pincushion correction.

Top and bottom keystone adjustment.

Horizontal overall and edge linearity adjustment.

Left and right pincushion and keystone correction waveform generation.

Sweep reversal for normal and inverted operation.

Generation of wave forms used for dynamic focus.

The block diagram (*see Figure 2-13*) description, along with the I/O description in the following section, provide information for module level troubleshooting.

Component numbering on the VDB, in general, follows the pattern that 2XX refers to components for Green deflection, 3XX refers to Blue, 4XX refers to Red (e.g.: R428 is a resistor in the red deflection amplifier). Likewise, the correction amplifiers are numbered 5XX for Green, 6XX for Blue, and 7XX for Red.

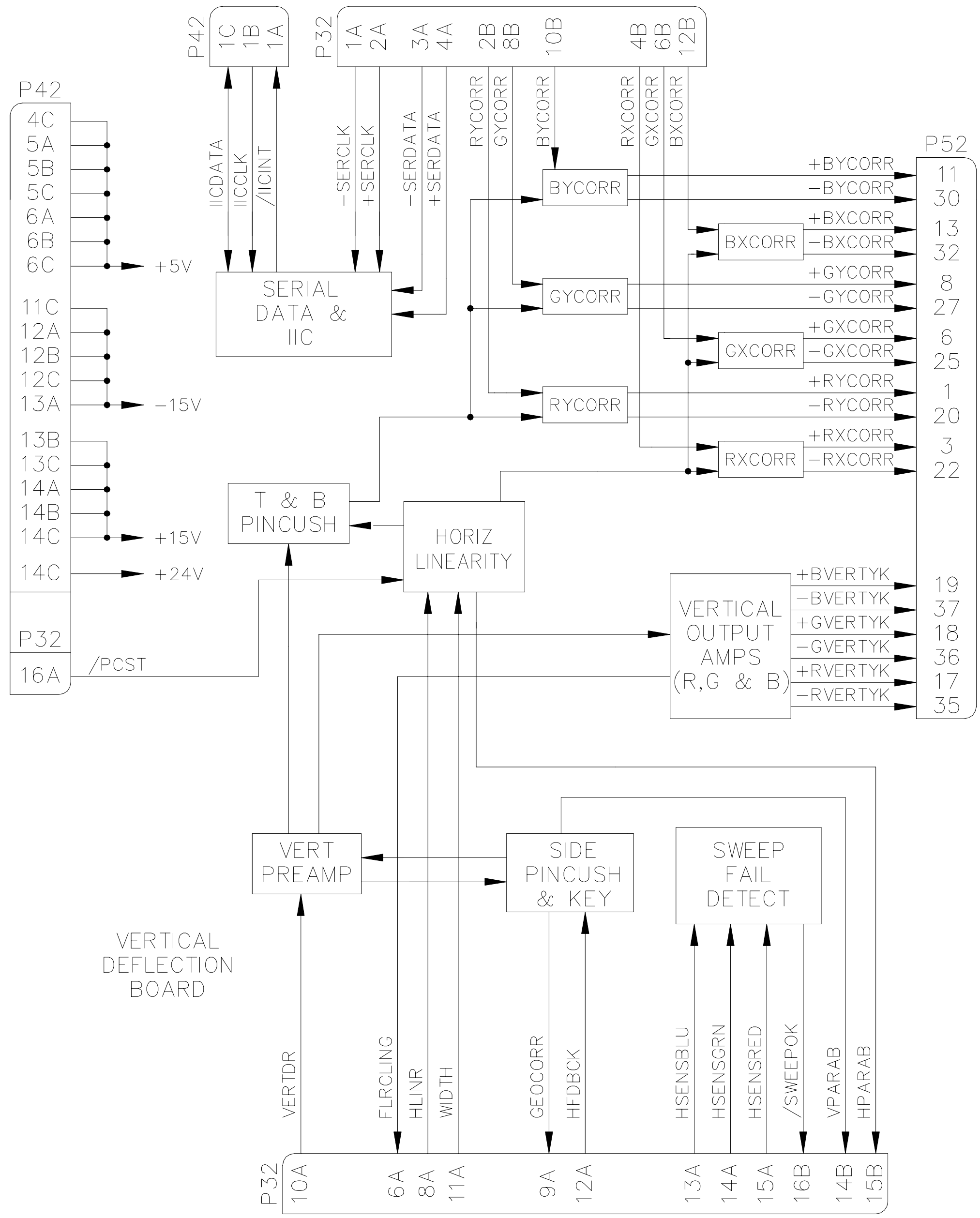


Figure 2-13 Vertical Deflection Board

Vertical Preamps

The vertical preamps (B, G, and R) each generate a ramp signal with the frequency determined by the incoming signal VERTDR from the Horizontal Deflection Board. The ramps generated in the preamp section have their common amplitude set by the commanded height and are corrected for vertical linearity (linearity is individually adjustable by R211, R311, and R411 and raster height is individually adjusted by R228, R328, and R428). The common raster height is adjusted by a signal sent from the SCB to the VDB via the serial bus. To control height, the operator presses the SIZE button on the remote control, then adjusts height with the up and down arrow keys. The ramp generated by the red preamp is used elsewhere in the VDB for the generation of correction signals.

Vertical Amplifiers

The Vertical Amplifiers take the ramp signals generated by the Vertical Preamps and provide further modification prior to driving the vertical deflection coils. Individual centering signals, set by the operator and controlled by the SCB are inserted in the Vertical Output Amps to provide offset for each vertical sweep. The centering of each individual color can be independently controlled by pressing the POS (Position) button on the remote control then selecting the desired color. The up and down arrow keys are then pressed to adjust vertical position. When controlling the position, Green is a master, i.e. when Green is selected, all three (3) colors move. Red and Blue are independent. After the centering signal is summed with the ramp signal, the result is amplified to produce the required amplitude signal to drive the main vertical deflection coils.

The Vertical Amplifiers output is sent to jumpers for reversing the direction of the vertical sweep for inverted operation. Jumpers J200, 300, and 400 are used for normal operation while J201, 301, and 401 are used for inverted operation. A signal is sent to the SCB indicating which mode of operation the jumpers are specifying.

Sweep Failure Detection

Current through the vertical deflection coil is sensed and that signal used to drive a sweep indication circuit. There is one (1) circuit for each of Green, Blue, and Red. The sweep indication circuit combines the vertical current signal with the horizontal flyback signal. The signals from Green, Blue, and Red are then combined to produce a signal, /SWEEPOK, that is sent to the VPB and indicates the health of all of the six (6) sweeps.

In addition to the /SWEEPOK signal, there are six (6) LEDs on the VDB which indicate the presence of the individual sweeps. The LEDs indicating vertical sweep health (LED200, 300, and 400) are driven by the vertical sweep signal alone. The horizontal sweep signals affect both of the appropriate color LEDs (e.g.: if the Blue vertical sweep fails, LED300 would turn off, but if the Blue horizontal sweep fails, LED300 and LED301 would both turn off).

Side Pincushion and Keystone Correction

This circuit uses the ramp from the Red preamp to generate a variable amplitude parabolic waveform for use in L/R pincushion correction. The Red ramp is also used to generate a variable amplitude and polarity ramp for L/R keystone correction. Both the L/R pincushion and keystone are controlled by the SCB sending a signal over the serial bus. The operator can control the L/R pincushion by pressing the PIN button on the remote control. The left and right arrow keys are then used to vary the amount of pincushion applied. Pressing the KEY button on the remote control can control the L/R keystone correction. The left and right arrow keys are then used to vary the amount of keystone correction applied. The two (2) waveforms are then summed.

This signal is then multiplied by HFDBK from the HDB. The resultant signal, GEOCORR, is sent to the HDB to modulate the horizontal width for side pincushion and keystone correction.

A form of the vertical frequency parabolic waveform that is derived from the red ramp is also sent out to the VPB as VPARAB for use in the dynamic focus circuit.

Horizontal Linearity Correction

The Horizontal Linearity Correction section provides correction for both horizontal overall linearity, and horizontal edge linearity. The WIDTH signal from the HDB and the /PCST signal from the RTG are combined to form a periodic ramp signal with horizontal frequency. The ramp signal is used to form a parabolic signal, again with horizontal frequency. This signal and a signal commanded by the operator, HLINCORR, combine to form a variable polarity and amplitude parabolic signal with horizontal sweep frequency. This signal is used for overall horizontal linearity correction. The parabola and ramp signals are also combined with the HLINLR signal, imported from the HDB, to produce an S-curve signal of variable polarity and amplitude, also with horizontal sweep frequency, to be used for edge linearity correction.

The operator can control each of these correction functions from the remote control by pressing the LIN key for overall linearity adjustment, or the EDGE key for edge linearity adjustment. The left and right arrow keys are then used to make the adjustments. The S-curve and parabola are then summed and sent to the Green, Blue, and Red X-correction amplifiers where the corrections are applied to the correction coils. The parabolic signal noted above, is also sent out to the VPB as HPARAB to be used in dynamic focus.

Top and Bottom Pincushion and Keystone Correction

A parabolic signal is borrowed from the horizontal linearity correction section for T/B pincushion correction. It is combined with an operator command signal, TBPNCORR, to produce a variable amplitude and polarity parabolic signal with horizontal sweep frequency.

A ramp signal, also from the horizontal linearity section, is used for T/B keystone correction. It is combined with an operator command signal, TBKEYCOR, to produce a variable amplitude and polarity parabolic signal with horizontal sweep frequency.

Both the T/B pincushion and keystone are controlled by the SCB sending signals over the serial bus. The operator can control the T/B pincushion by pressing the PIN button on the remote control. The up and down arrow keys are then used to vary the amount of pincushion correction applied. Pressing the KEY button on the remote control can control the T/B keystone correction. The up and down arrow keys are then used to vary the amount of keystone correction applied.

These two (2) signals are combined with the red ramp, having the frequency of the vertical sweep, from the vertical pre-amp, to produce the top and bottom pincushion and keystone correction waveform. This signal is then sent to the Green, Blue, and Red Y-correction amplifiers. The operator can control the phase relationship of the T/B pincushion, T/B keystone, and horizontal linearity, with respect to the picture.

To control these parameters, the operator selects PINCUSHION POSN from the TIMING SETUP MENU under the MAIN MENU. The left and right arrow keys are then used to vary the position of the corrections.

Correction Amplifiers

There are six (6) correction amplifiers. Each one receives a real-time convergence correction signal:

RXCORR.
RYCORR.
GXCORR.
GYCORR.
BXCORR.
BYCORR, from the SCB convergence section.

The X-correction amplifiers, R, G, and B, also receive the horizontal linearity signal. The horizontal linearity signal is then combined with the appropriate color's X-correction signal to produce a composite horizontal correction signal. The Y-correction amplifiers, R, G, and B, receive the top and bottom pincushion and keystone correction signal. The pin and key correction signal is then combined with the appropriate color's Y-correction signal to produce a composite vertical correction signal. All six (6) correction signals are then amplified by the correction amplifiers and are sent to their respective yoke coils.

Serial Communication

The VDB uses two (2) separate, interrelated serial data communication systems to communicate with the SCB; the IIC bus, and a differential, synchronous data bus. The information transferred over the serial busses is indicated below (I = input to VDB, 0 = output from VDB). Also noted is whether the information is transferred over the IIC or the serial bus. A change in output data generates an interrupt pulse.

Table 2-8 VDB Serial Bus Information

Bus	I/O	Information	Description
IIC	**O**	Front/Rear convergence indication	TTL level that indicates whether the X-convergence is in front screen mode (high) or rear screen (pulled low).
IIC	**I**	Serial data load	Command to the serial data receiver that the incoming data is to be read.
Serial	**I**	VH	Commanded vertical height of picture.
Serial	**I**	VCENTBLU	Commanded vertical position of blue raster.
Serial	**I**	VCENTGRN	Commanded vertical position of green raster.
Serial	**I**	VCENTRED	Commanded vertical position of red raster.
Serial	**I**	TRAPCORR	Commanded L/R keystone correction.
Serial	**I**	LRPNCORR	Commanded L/R pincushion correction.
Serial	**I**	TBPNCORR	Commanded T/B pincushion correction.
Serial	**I**	HLINCORR	Commanded overall horizontal linearity correction.

General I/O

This section provides a comprehensive description of the inputs to and outputs from the VDB. The I/O description are arranged by the source/destination of the signal and so the assemblies communicated with are used as the primary heading of each group of signals and then are further subdivided into inputs and outputs. In each case, the signal's direction is noted, with input referring to an input *to* the RTG, and output to an output *from* the VDB. (e.g. under 'Raster Timing Generator', 'Input'; /PCST refers to the signal /PCST that is an *input* to the VDB from the Raster Timing Generator). When test points are provided for the I/O they are noted.

Table 2-9 Vertical Deflection Board I/O Signals

System Controller Board	
Input	**Description**
IICCLK	IIC clock line. Unidirectional clock line for control of synchronous data transfer over IIC data bus.
RXCORR	A 0-1 V signal from the bit-mapped memory on the SCB. 0.5V represents no correction. This is a real time signal representing the X correction on red.
RYCORR	Similar to RXCORR.
GXCORR	Similar to RXCORR.
GYCORR	Similar to RXCORR.
BXCORR	Similar to RXCORR.
BYCORR	Similar to RXCORR.
+SERCLK	Serial data transfer clock (+). Unidirectional, differential clock line from SCB to other circuit boards. Used for synchronous control of serial communication over SERDATA data lines.
-SERCLK	Serial data transfer clock (-).

+SERDATA	Serial data transfer. Unidirectional, differential, synchronous serial data communication line. Used for transferring data from SCB to other circuit boards. Uses SERCLK and IIC for control of receiver.
-SERDATA	Serial data transfer.

System Controller Board	
Output	**Description**
/IICINT	IIC interrupt line. Signal line for slave boards to inform the SCB (master) that there is data to be transferred. Master then polls slaves to determine the source of the interrupt.

I/o	**Description**
IICDATA	IIC data line. Bi-directional serial line for synchronous data transfer between SCB and other circuit boards. See detailed description for list of signals transferred and data direction.

Raster Timing Generator	
Inputs	**Description**
/PCST	Clock signal to start T/B pincushion, T/B Keystone, and horizontal linearity correction.

Video Processor Board	
Outputs	**Description**
HPARAB	Parabolic signal at horizontal frequency for dynamic focus.
VPARAB	Parabolic signal at vertical frequency for dynamic focus.
/SWEEPOK	Low indicates that all six sweeps are occurring at normal frequencies.

Horizontal Deflection Board	
Inputs	**Description**
HSENSRED	+15V indicates red horizontal flyback occurring at normal frequencies.
HSENSBLU	Similar to HSENSRED.
HSENSGRN	Similar to HSENSRED.
HFDBCK	Voltage representing amount of horizontal scan drive. Used for modifying amount of side pincushion and keystone when changing horizontal frequency.
WIDTH	Positive DC voltage representing commanded width of the raster. Used for generation of horizontal linearity ramp and T/B pincushion correction waveform.
VERTDR	Pulse signal at vertical frequency from the vertical oscillator on the HDB.
HLINR	Voltage representing commanded horizontal linearity correction.
TBKEYCOR	Voltage representing commanded top and bottom keystone correction.

Outputs	Description
FLRCLING	Low signal generated from jumper on connector J400 indicates non-inverted operation.
GEOCORR	Output from L/R pincushion and keystone correction circuits.

Main Vertical Deflection Coils	
Outputs	**Description**
+RVERTYK	Supply line to the main vertical deflection coil (red) after going through FLRCLING jumper plug.
-RVERTYK	Return from main vertical deflection coil (red) after going through FLRCLING jumper plug.
+GVERTYK	Similar to +RVERTYK.
-GVERTYK	Similar to -RVERTYK.
+BVERTYK	Similar to +RVERTYK.
-BVERTYK	Similar to -RVERTYK.

Correction Coils	
Outputs	**Description**
+RXCORR	Supply to the red X correction coil.
-RXCORR	Return from the red X correction coil.
+RYCORR	Similar to +RXCORR.
-RYCORR	Similar to -RXCORR.
+GXCORR	Similar to +RXCORR.
-GXCORR	Similar to -RXCORR.
+GYCORR	Similar to +RXCORR.
-GYCORR	Similar to -RXCORR.
+BXCORR	Similar to +RXCORR.
-BXCORR	Similar to -RXCORR.
+BYCORR	Similar to +RXCORR.
-BYCORR	Similar to -RXCORR.

System Power Supplies	
Inputs	**Description**
+24V	Power to vertical deflection.
+15V	Power for analog portions of VDB.
-15V	Power for analog portions of VDB.
+5V	Power for digital devices on VDB.
GND	Return for power on VDB.

Interlocks and Shutdowns

Input

HSENSRED - Used to shut down the CRT beams in the event of horizontal sweep failure.

HSENSGRN - Identical to HSENSERED.

HSENSBLU - Identical to HSENSERED.

Output

/SWEEPOK

Indicates whether or not all sweeps are occurring at or above a minimum frequency. Used on the VPB to turn off the signal in the event of loss of sweep.

Internal

None

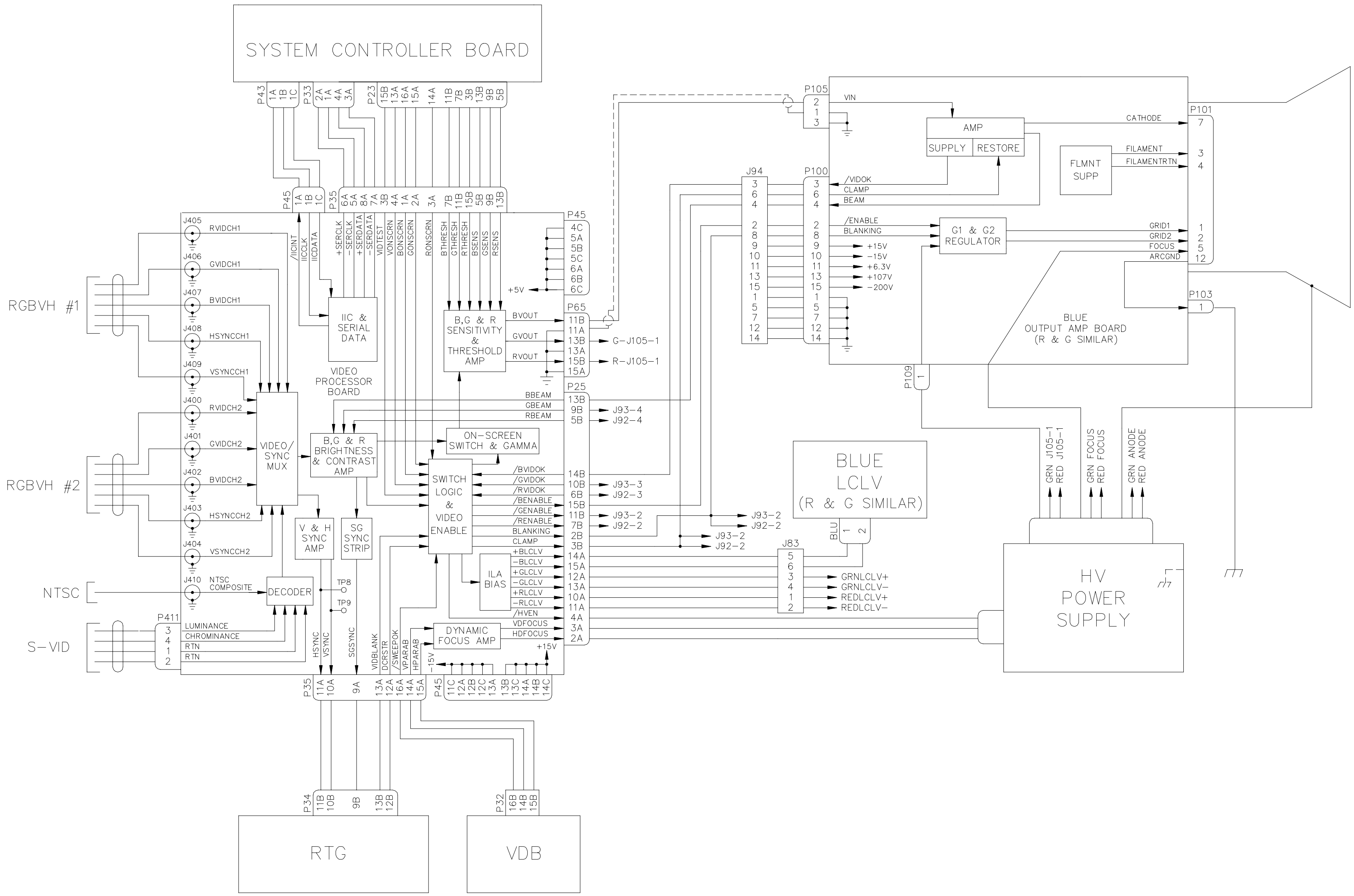


Figure 2-14 Video Generation Block Diagram. This diagram provides an overall view of how the image is produced. Separate sections of this chapter detail the individual PCBs.

Video Processor Board P/N 104672 (VPB)

The Video Processor Board (VPB) plugs into the electronics card cage.
It is the rear-most card in the card cage. The VPB is the only card in the card cage that is held in by fasteners. There are four screws that tie the input tray to the rear panel of the card cage. The input tray is an aluminum panel that attaches to the VPB input BNC connectors. The input tray is a separate assembly and is not included with the VPB when a new or repaired board is shipped.

The following functions are provided by the VPB:

Image and sync signal input.

Image and sync signal multiplexing.

Sync signal stripping.

Brightness and contrast control.

CRT protection logic.

Internal and external display multiplexing.

Image signal gamma correction.

LCLV uniformity correction.

LCLV bias.

Dynamic focus signal modification.

The block diagram (Figure 2-15) description, along with the I/O description in the following section, provide information to perform module-level troubleshooting.

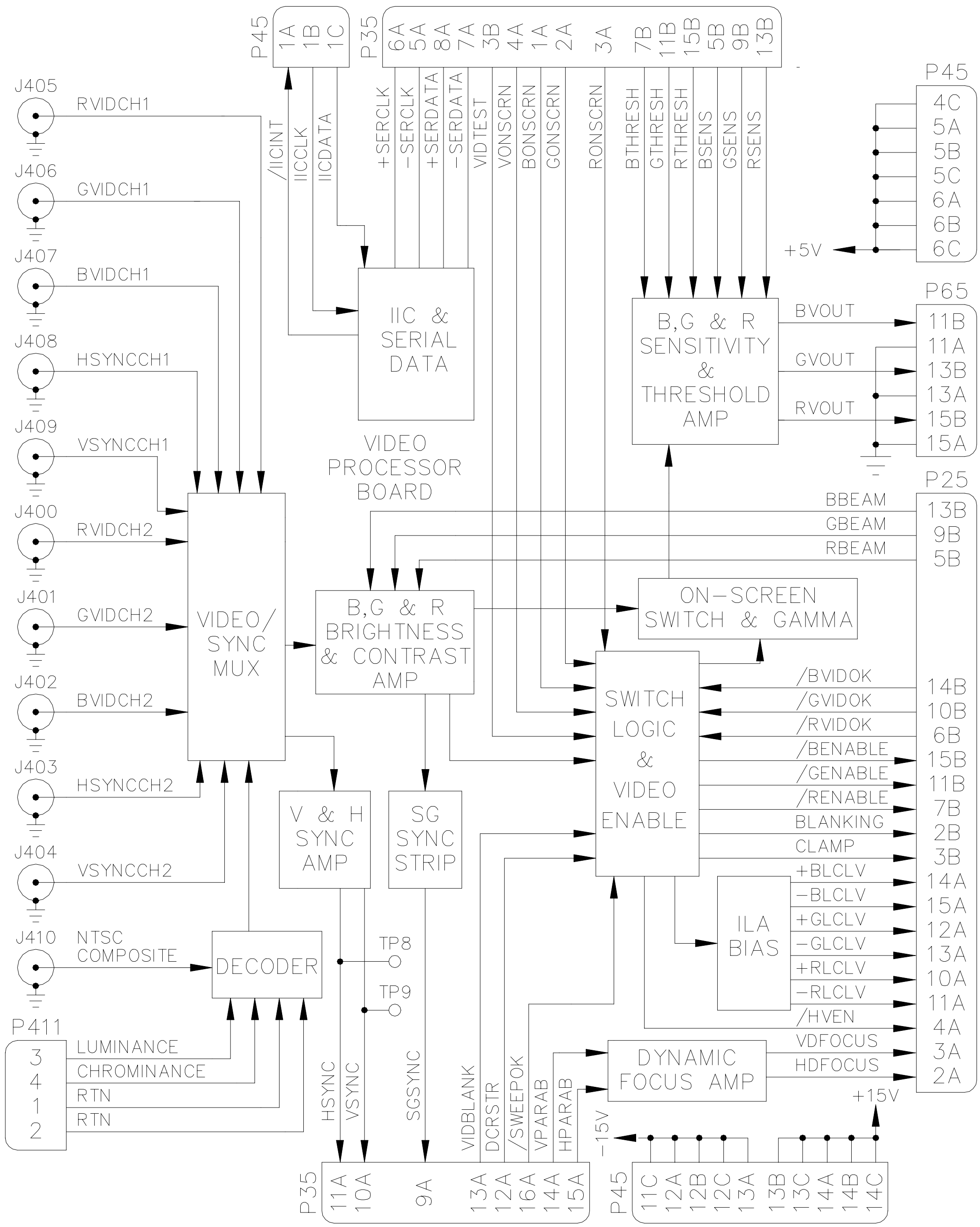


Figure 2-15 Video Processor Board, Block Diagram

Decoder

The optional decoder is a daughter board installed on the VPB. Since the VPB can only operate on an RGB/sync signal, use of the decoder is necessary in order for the projector to use a composite signal. The decoder takes a composite (NTSC, PAL, or SECAM) or S-Vid input and converts it into an RGB Sync signal for further use in the Video Processor Board. The IIC bus is used by the decoder to select either Channel 3 (NTSC) or Channel 4 (S-Vid). The two (2) signals are multiplexed together on the decoder board for export to the Video/Sync Mux.

Video/Sync Mux

The Video/Sync Mux selects one (1) of three (3) external inputs (RGB1, RGB2, or Decoder) for use as the source for Image display and sync signals. The two (2) external RGB Sync signals are selected by choosing RGB1 or RGB2 in the CHANNEL LIST under the CHANNEL MENU. Selecting either CVID (for the composite input) or SVHS (for the S-Vid input) from the same CHANNEL LIST uses the input from the decoder. The input to be used is selected by the System Controller Board via the IIC bus. A green LED on the input panel is lit to indicate which input is selected. The RGB image inputs are AC coupled while the sync and decoder inputs are DC coupled. All inputs have a 75 ohm input impedance.

V & H Sync Strip

The vertical and horizontal sync signals are taken from the Video/Sync Mux and individually peak and trough detected then pulse shaped to provide a TTL-level signal representing the HSYNC and the VSYNC. Those signals are then sent out to the RTG as the signals HSYNC and VSYNC and can be monitored on TP 14 and 15 respectively.

SG Sync Strip

The SG Sync Strip circuit looks at the green image signal between the video MUX and the Brightness and Contrast Amp and sends the signal through a buffer then peak detects the signal. The peak-detected signal then is compared with a reference voltage to discriminate the sync signal from the video. The stripped sync signal is then pulse shaped to provide a TTL representation of the composite sync signal. The signal is sent out to the RTG as SGSYNC and can be probed at TP 13.

B, G, and R Brightness and Contrast Amplifiers

Each color of video (R, G, and B) uses an identical circuit. The Brightness and Contrast amplifier serves to adjust the black and white levels of the external video and also protects the CRT from excessive beam current by taking the beam current signal from the Video Output Amp and comparing it with a reference. If the beam current exceeds 1mA, the contrast command voltage is reduced to a level that brings the CRT beam current back within bounds.

The Brightness and Contrast amplifier takes the contrast command signal after the beam current limit circuit, and uses it to set the gain of the amplifier for contrast control. Contrast is controlled by the SCB via the IIC interface. The operator controls contrast level by pressing the CONT button and using the up and down arrows on the remote control. Green is a master and will control all three (3) colors together. R and B are independent.

Adding a DC offset to the output of the amplifier controls brightness. The brightness is controlled by the SCB via the IIC interface. The operator controls contrast level by pressing the BRIGHT button and using the up and down arrows on the remote control. All three (3) colors are controlled together. During the DC Restore interval when the BPCP pulse (measured at TP 10) is high, the output of this amp is set to the nominal DC level.

On-Screen Switch

In the on-screen switch, the external video signal is multiplexed, in real time, with internal video signals. The internal video signals used are full brightness, black, or gray-scale/pyramid for a total of four (4) different signals that are multiplexed at each point on the screen. The real-time multiplexing is used for the generation of overlays and test patterns and is controlled by the switch logic. The output of the on-screen switch can be monitored by test points TP5 (Red), TP6 (Green), and TP7 (Blue).

Gamma Correction

After the On-Screen Switch the signal goes to the Gamma Correction section. Gamma Correction is a non-linear gain stage that accounts for the non-linearities of the ILA® Assemblies as well as for the CRT to produce a linear gray-scale on the screen for a linear gray-scale input.

Switch Logic and Video Enable

This section controls the overlays and test patterns on the screen as well as providing protective functions.

Protection of the CRTs is accomplished by sensing dangerous conditions and initiating protective functions. There are three (3) conditions that the projector considers dangerous to the CRTs that are addressed in this circuit. Those three (3) conditions are loss of sweep (any of the six), defective video amp, and loss of power to the VPB.

When a loss of sweep occurs, the /SWEEPOK signal is released by the VDB and is pulled high by the VPB. This initiates two (2) protective functions. First (1st) is that the video signal is immediately cut off. This is the fastest way to reduce the CRT beam current to prevent CRT damage. It is also the least effective since even when there is no video signal to the video amp, there can still be beam current due to a high G2 or other causes. Therefore, a second (2nd) function is initiated when /SWEEPOK goes high. The enable signal to the video amps, /RENABLE, /GENABLE, and /BENABLE is released by the VPB (all three [3] regardless of which sweep is lost) and pulled high by the VAB. When this happens, it signals the VAB to remove some of the bias voltage from its CRT. This further reduces the possibility that there will be any beam current present during loss of sweep and although more effective than removing video signal, it takes more time.

A defective video amp is detected by the state of the /RVIDOK, /GVIDOK, and /BVIDOK signals arriving from the VABs. A loss of +5V power to the VPB is detected by observing it internally to this circuit. When any one of the VIDOK signals goes high or a loss of +5V is detected, action will be taken to shut down all three (3) CRTs.

Loss of +5V or defective VAB can potentially be more serious than loss of sweep. Therefore, when one (1) of these conditions occurs, the same action will be taken as for loss of sweep with the additional action of shutting down the HVPS. This is done by releasing the /HVEN line allowing the HVPS to pull it high. Turning off the HVPS is the most effective way of protecting the CRT but is also slowest—explaining why other actions are taken in conjunction.

Switch logic is the portion of the circuit that controls what is seen on the screen at any point at a given time. The SCB sends out signals as the raster is scanned. These signals are outputs from the on-screen display bit-map. The signals controlling on-screen video are BONSCRN, RONSCRN, GONSCRN, VONSCRN, and VIDTEST. The signals are decoded in PALs on the VPB and result in signals that control the on-screen switch multiplexers to display the test patterns, text, and video.

Switch logic also takes in the signals from the RTG that control DC restore (DCRSTR) and blanking (VIDBLANK) and distributes them throughout the VPB and out to the VAB as the signals CLAMP and BLANKING.

RGB Sensitivity and Threshold Amplifier

Each color of video (R, G, and B) uses an identical circuit.

The video signal is taken from the output of the gamma correction section, amplified, and sent off the VPB to the VAB via signals RVOUT (TP1), GVOUT (TP2), and BVOUT (TP3).

The Threshold correction adds an offset to the signal in similar fashion to that of the brightness control in the Brightness and Contrast Amp. The difference is that the Threshold correction is, in general, not a pure DC signal, nor does the beam current limit circuit affect it. Rather, it is a varying signal generated by the System Controller Board in real time representing the correction necessary to account for turn-on-point variations across the ILA® Assemblies. The signals from the SCB are RTHRESH, GTHRESH, and BTHRESH. Also, when the clamp pulse signals that it is time to do DC restore, the /BPCP signal removes the threshold correction so that it will be reapplied after DC restore.

Sensitivity correction is applied by varying the gain of the amplifier. Like threshold correction, the sensitivity correction signal that controls the gain is not, in general, pure DC nor affected by beam current limit. It is a varying signal generated by the System Controller Board in real time representing the correction necessary to account for sensitivity variations across the ILA® Assemblies. The signals for sensitivity correction from the SCB are RSENS, GSENS, and BSENS.

Video signal cutoff is accomplished by pulling blanking to zero.

ILA® Bias

ILA® Assembly biasing is accomplished by generating a pseudo-square-wave with frequency set by the operator. The SCB sends the information on bias frequency via the IIC interface to the VPB. The operator can control the frequency over a range of from 1.5KHz to 3.0KHz. Selecting ILA BIAS FREQ from the ILA SETUP menu under the MAIN MENU controls the frequency. The bias square wave is phase locked to the vertical sync to prevent any moving artifacts from occurring on the screen due to bias.

The bias square wave is passed through an amplifier whose gain is set by the operator via the SCB to vary the bias. This square wave is then turned into a differential output in order to eliminate DC going to the **ILA®** Assemblies. The outputs can be monitored at TP11 and 12 (RED), 1 and 14 (GRN), and 15 and 16 (BLU). Selecting BIAS W/O VIDEO from the ILA SETUP MENU under the Main Menu controls the bias level for each individual color. The up and down arrows are then used to vary the bias level.

Dynamic Focus Amplifier

The vertical focus amplifier takes the VPARAB signal from the VDB, amplifies it and sends it out to the HVPS as the signal VDFOCUS for vertical dynamic focus. The HPARAB signal, from the VDB, is multiplied by the VPARAB signal, amplified, and also sent out to the HVPS as the signal HDFOCUS for horizontal dynamic focus.

Serial Communication

The VPB uses two (2) separate, interrelated serial data communication systems to communicate with the SCB; the IIC bus, and a differential, synchronous data bus. The information transferred over the serial busses is indicated below (I = input to VPB, O = output from VPB). Also noted is whether the information is transferred over the IIC or the serial bus. A change in output data generates an interrupt pulse.

Table 2-10 VPB Serial BUS Information

BUS	I/O	Information	Description
IIC	**I**	RENABLE	Signal to cut off red.
IIC	**I**	GENABLE	Signal to cut off green.
IIC	**I**	BENABLE	Signal to cut off blue.
IIC	**I**	CH1SEL	Selects RGB1 as input.
IIC	**I**	CH2SEL	Selects RGB2 as input.
IIC	**I**	**ILA®** bias freq	Information for setting bias frequency to **ILA®** Assembly.
IIC	I	SLOAD	Command to the serial data receiver that the incoming data is to be read.

IIC	O	VIDOK	Tells SCB that no VABs are reporting problems.
IIC	O	SWEEPOK	Tells SCB that all sweeps are operating.
IIC	O	BEAMDET	Tells SCB that beam current limiting is occurring.

BUS	I/O	Information	Description
Serial	I	REDBIAS	Commanded amplitude of red LCLV bias.
Serial	I	GRNBIAS	Commanded amplitude of green LCLV bias.
Serial	I	BLUBIAS	Commanded amplitude of blue LCLV bias.
Serial	I	RCONT	Commanded red contrast.
Serial	I	GCONT	Commanded green contrast.
Serial	I	BCONT	Commanded blue contrast.
Serial	I	BRIGHT	Commanded brightness level.

General I/O

This section provides a comprehensive description of the inputs to and outputs from the VPB. The I/O description are arranged by the source/destination of the signal and so the assemblies communicated with are used as the primary heading of each group of signals and then are further subdivided into inputs and outputs. In each case, the signal's direction is noted, with input referring to an input *to* the RTG, and output to an output *from* the VPB. (e.g.: under Raster Timing Generator 'Input'; VSYNC refers to the signal VSYNC that is an *input* to the VPB from the Raster Timing Generator). When test points are provided for the I/O they are noted.

Table 2-11. Video Processor Board I/O Signals

System Controller Board	
Input	**Description**
IICCLK	IIC clock line. Unidirectional clock line for control of synchronous data transfer over IIC data bus.
BONSCRN	Along with RONSCRN, GONSCRN, VONSCRN, VIDBLANK, and DCRSTR (the later two on from the RTG board) determines whether there is full brightness, black, gray-scale, or external video presented in blue at a given point on the screen.
RONSCRN	Similar to BONSCRN.
GONSCRN	Similar to BONSCRN.
VONSCRN	Determines if internal test patterns will be shown.
VIDTEST	Internal gray-scale video input information. Real time data 0V to 1V.
RSENS	Sensitivity (Z-axis gain) correction information for red. Real time data at 0V to 1V.
GSENS	Similar to RSENS.
BSENS	Similar to RSENS.

RTHRESH	Threshold (Z-axis offset) correction information for red. Real time data at 0V to 1V.
GTHRESH	Similar to RTHRESH.
BTHRESH	Similar to RTHRESH.
+SERCLK	Serial data transfer clock (+). Unidirectional, differential clock line from SCB to other circuit boards. Used for synchronous control of serial communication over SERDATA data lines.
-SERCLK	Serial data transfer clock (-).
+SERDATA	Serial data transfer. Unidirectional, differential, synchronous serial data communication line. Used for transferring data from SCB to other circuit boards. Uses SERCLK and IIC for control of receiver.
-SERDATA	Serial data transfer.
System Controller Board	
Outputs	**Description**
/IICINT	Interrupt used to tell the SCB that the VPB has data to report.
I/O	Description
IICDATA	IIC data line. Bi-directional serial line for synchronous data transfer between SCB and other circuit boards. See detailed description for list of signals transferred and data direction.

Raster Timing Generator	
Inputs	**Description**
VIDBLANK	Along with RONSCRN, GONSCRN, BONSCRN, and VONSCRN from the SCB, and DCRSTR, determines whether there is full brightness, black, gray-scale, or external video presented at a given point on the screen.
DCRSTR	Along with RONSCRN, GONSCRN, BONSCRN, VONSCRN, from the SCB, and VIDBLANK, determines whether there is full brightness, black, gray-scale, or external video presented at a given point on the screen.

Outputs	**Description**
SGSYNC	Stripped Green Sync. The composite sync signal stripped from the green channel (if it exists) (TP13).
HSYNC	Horizontal Sync. This can be either just the horizontal sync, in which case there will be a separate vertical sync, or HSYNC can be a composite sync. (TP14)
VSYNC	Vertical Sync. This cannot be a composite sync signal. (TP15)

Vertical Deflection Board	
Inputs	**Description**
VPARAB	A periodic, positive-going, parabolic waveform with the vertical scan frequency, used for dynamic focus.
HPARAB	A periodic, positive-going, waveform with the horizontal scan frequency, used for dynamic focus.
/SWEEPOK	A TTL DC level signal indicating that, when low, indicates all flybacks are occurring at or above a minimum frequency.

Video Amplifier Board	
Inputs	**Description**
RBEAM	Voltage signal proportional to cathode current averaged over several horizontal lines, in the red CRT. Voltage level is +1mV/uA.
GBEAM	Similar to RBEAM.
BBEAM	Similar to RBEAM.
/RVIDOK	Open collector signal indicating the health of the red +100V cathode supply.
/GVIDOK	Similar to /RVIDOK.
/BVIDOK	Similar to /RVIDOK.

Video Amplifier Board	
Outputs	**Description**
BLANKING	Pulse signal output that is a buffered replica of the VIDBLANK input from the SCB. Indicates the commanded blanking interval during the scan.
/BENABLE	Logical connection of video amp, sweep, and power health indications. TTL level output.
/RENABLE	Identical to /BENABLE.
/GENABLE	Identical to /BENABLE.
RVOUT	Red video output. 0V to 1V (TP1).
GVOUT	Green video output. 0V to 1V (TP2).
BVOUT	Blue video output. 0V to 1V (TP3).
CLAMP	Pulse signal output that is a buffered replica of the SCRSTR input from the SCB. Indicates the commanded timing and duration of the DC restore.

External Video	
Inputs	**Description**
RVIDCH1	Red video input to channel 1.
RVIDCH2	Red video input to channel 2.
GVIDCH1	Green video with optional composite sync signal input to channel 1.
GVIDCH2	Green video with optional composite sync signal input to channel 2.

BVIDCH1	Blue video input to channel 1.
BVIDCH2	Blue video input signal to channel 2.
HSYNCCH1	Horizontal or composite sync signal to channel 1.
HSYNCCH2	Horizontal or composite sync signal to channel 2.
VSYNCCH1	Vertical sync signal to channel 1.
VSYNCCH2	Vertical sync signal to channel 2.
COMPVID	Composite video signal, pass through to decoder.
LUM	Luminance signal for SVHS, pass through to decoder.
CHROM	Chrominance signal for SVHS, pass through to decoder.
RTN	Return for SVHS; pass through to decoder.

Image Light Amplifiers	
Outputs	**Description**
+RLCLV	One half (½) of the differential pair providing a distorted square wave to the red ILA. (TP 21)
-RLCLV	One half (½) of the differential pair providing a distorted square wave to the red ILA. (TP 20)
+GLCLV	Similar to +RLCLV. (TP 19)
-GLCLV	Similar to -RLCLV. (TP 18)
+BLCLV	Similar to +RLCLV. (TP 17)
-BLCLV	Similar to -RLCLV. (TP 16)

Decoder	
Inputs	**Description**
RED	Red video signal from decoder.
GREEN	Green video signal from decoder.
BLUE	Blue video signal from decoder.
SYNC	Horizontal sync signal from decoder.
IICINT	Interrupt signal from decoder, pass through to SCB.
CH3SEL	Indicates to VPB that video input is composite.
CH4SEL	Indicates to VPB that video input is SVHS.
VERT	Vertical sync signal from decoder.

Outputs	**Description**
SCLK	Single ended serial clock from serial communication bus to decoder.
SDATA	Single ended serial data from serial communication bus to decoder.
IICCLK	IIC clock pass through to decoder.
IICDATA	IIC data pass through to decoder.
COMPVID	Composite video signal, pass through to decoder.
LUM	Luminance signal for SVHS, pass through to decoder.
CHROM	Chrominance signal for SVHS, pass through to decoder.
RTN	Return for SVHS; pass through to decoder.

High Voltage Power Supply	
Outputs	**Description**
VDFOCUS	Parabolic waveform of vertical frequency.
HDFOCUS	Parabolic waveform of horizontal frequency modulated by the VDFOCUS waveform.
/HVEN	Enable signal for HVPS, used to shut down HVPS for CRT protection.

System Power Supply	
Inputs	**Description**
+5V	Power supply to digital components.
GND	Return from digital components.
+15V	Power supply to analog components.
-15V	Power supply to analog components.
GND (TP 0)	Return from analog components.

Interlocks and Protection

Input

/SWEEPOK

TTL high indicates that one or more of the sweeps, either horizontal or vertical is not at or above the minimum amplitude and frequency. This will cause a cutoff so that RVOUT, GVOUT, and BVOUT will be pulled low. Additionally, /RENABLE, /GENABLE, and /BENABLE will be pulled high resulting in shutdown of grid bias at the Video Output Boards. Also, the SWEEPOK status bit will be transmitted to the SCB.

RBEAM

Signal representing average red CRT beam current at 1mV/1uA. At greater than 0.7V, causes contrast and overlay intensity on all three colors to be reduced.

GBEAM

Similar to RBEAM.

BBEAM

Similar to RBEAM.

/RVIDOK

High indicates low voltage at the +100V supply on the red Video Output Board. This causes a low at the VIDOK status bit sent to the SCB over the IIC. The /HVEN signal is allowed to go high shutting down the HVPS. Additionally, a high cutoff signal is sent so RVOUT, GVOUT, and BVOUT will be pulled low. /RENABLE, /GENABLE, and /BENABLE are also pulled high resulting in shutdown of grid bias at the Video Amplifier Boards. Also, the SWEEPOK status bit will be transmitted as a low to the SCB.

/GVIDOK

Similar to /RVIDOK.

/BVIDOK

Similar to /RVIDOK.

Output

/HVEN

When either /RVIDOK, /GVIDOK, or /BVIDOK from the Video Amplifier Boards is pulled high, or the +5V power on the Video Processor Board goes low, /HVEN is pulled high. This results in the HVPS being disabled, thus shutting down high voltage to the CRTs.

/RENABLE

High will cause grid voltages at the VAB to be pulled low shutting off the red CRT beam. High will result from high on /RVIDOK, /GVIDOK, or /BVIDOK from the VAB, +5V power going down on the VPB, or /SWEEPOK being pulled high from the VDB.

/GENABLE

Similar to /RENABLE.

/BENABLE

Similar to /RENABLE.

Internal

None

Video Amplifier Board P/N 103567 or 103774 (VAB)

The Video Amplifier Board (VAB) is mounted on and plugs into the back of the CRT. There are three (3) VABs—one (1) on each CRT and each is entirely dedicated to servicing its respective CRT. The video amplifier boards are the last stage of the video chain and provide all electrical connection to the CRTs except for anode voltage and chassis bond.

The following functions are provided by the VPB:

Connection of all voltages to CRT.

Amplification of video signal.

Blanking.

DC restore.

Bias voltage control.

Circuit failure detection.

Beam current sense.

Arc protection.

This section uses Figure 2-16 for reference. The description provides information to perform module-level troubleshooting.

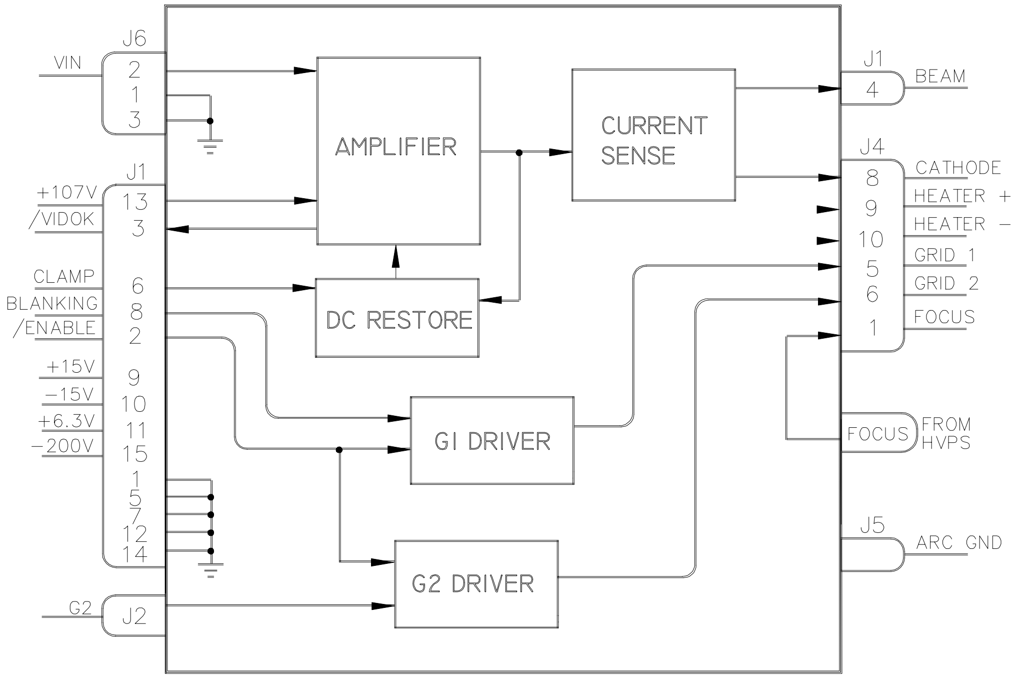


Figure 2-16 Video Amplifier Board, Block Diagram

Video Signal

The video signal comes directly from the VPB backplane connector via a coaxial cable to the Video Amplifier Board and enters as VIN. The input signal will be a maximum of 1Vpp. The video amplifier takes the input signal, amplifies and level shifts it so that it will be a negative-going 75Vpp signal modulating the +84Vdc black level, and applies this to the cathode of the CRT. In general, the 84Vdc black level will be seen only during the DC Restore interval. Power for the video amplifier is a locally derived 100V that is regulated down from the 107V input from the SPS.

Failure Detection

The Failure Detection circuit senses the health of the video amp's 100V power supply. When the 100V supply falls below about +64V, the normally low /VIDOK signal is pulled high. The /VIDOK signal is then sent to the VPB.

Beam Current Sense

The cathode current is sensed at the output of the video amplifier, then filtered and amplified so that the output is a 1mV/1uA signal averaged over several horizontal lines (the number of lines depending on the horizontal frequency). This current sense signal is then sent to the VPB as the signal BEAM.

DC Restore

The DC Restore function is accomplished on the Video Amplifier Board when commanded by the CLAMP signal from the VPB. When the CLAMP signal arrives, the video signal has the offset values (Brightness and Threshold) removed so that they will not be changed by the DC Restore circuit. The CLAMP signal causes the output voltage to be sampled and compared to a reference. The difference is sent to the input of the video amplifier to set the new black level for the duration of the next horizontal line.

Arc Protection

The Arc Protection Circuit functions to drain off any energy that arrives at the Video Output Amplifier board due to arcs on the cathode or grids. The arc energy is suppressed by sending it directly to the HVPS chassis via the Arc Ground terminal on the board.

Blanking

The Blanking circuit operates by using the BLANKING signal from the VPB. The BLANKING signal causes an amplifier to drive an AC coupled pulldown of GRID1. G1 voltage is normally -81V but will be pulled down to -111V during the blanking interval. The cathode voltage is unaffected by blanking.

Enable Circuit

The Enable circuit is controlled by the /ENABLE signal from the VPB. The /ENABLE signal, when pulled high, causes both GRID1 and GRID2 to be pulled low: G1 is pulled from nominal -81V to the disabled value of -200V, G2 is pulled from its usual value of between +800V to +1200V to its disabled value of +15V.

Focus

The FOCUS voltage is a pass through from the HVPS to the CRT. It is not in any way modified by the VOB.

Filament Supply

For the CRT Filament supply, 6.3Vdc from the System PS is simply filtered and sent to the CRT.

General I/O

This section provides a comprehensive description of the inputs to and outputs from the VAB. The I/O description are arranged by the source/destination of the signal and so the assemblies communicated with are used as the primary heading of each group of signals and then are further subdivided into inputs and outputs. In each case, the signal's direction is noted, with input referring to an input to the VAB, and output to an output from the VAB (e.g.: under Video Processor Board; 'Input'; CLAMP refers to the signal CLAMP that is an input to the VAB from the Video Processor Board). When test points are provided for the I/O they are noted.

Table 2-11 Video Amplifier Board I/O Signals

Video Processor Board	
Input	**Description**
VIN	COAX input from VPB via the backplane. Video signal of 1V peak-to-peak maximum.
/ENABLE	TTL level DC signal which controls grid voltages. High causes G2 to be pulled to +15V and G1 to be pulled to -200V shutting off the CRT beam.
CLAMP	TTL level pulse controlling DC restore. Restores black level of cathode voltage to +84V.
BLANKING	TTL level signal controlling video blanking. Pulls G1 to 30V below normal voltage to turn off beam.

Outputs	**Description**
BEAM	Positive voltage indicating beam current averaged over several lines. 1mV = 1uA of beam current.
/VIDOK	Indicates health of the +100V cathode supply. Open collector output opens when supply goes below 64V.

CRTs	
Output	**Description**
FOCUS	Focus voltage directly from HVPS to CRT.
GRID1	Regulated DC voltage to Grid1. Nominally -81V during normal operation. During blanking, G1 is -111V, and during /ENABLE high, G1 is -200V.
GRID2	Variable DC voltage to Grid2. G2 voltage is normally 800 to 1200V. When /ENABLE high, G2 is 15V.
CATHODE	DC black level modulated by video signal. DC black level is +84V. Modulation is negative-going 75V peak-to-peak max.
FILAMENT	6.3V filtered goes to filament.
FILAMENT RTN	Return from filament supply.

High Voltage Power Supply	
Inputs	**Description**
-200V	Power supply to Grid1 regulator.
FOCUS	Pass-through from HVPS to CRT.
G2	+100V to +1400V supply to Grid2. Passes through G2 pulldown circuit for protection.

System Power Supply	
Inputs	**Description**
+107V	Power supply to cathode drive amplifier.
+6.3V	Power supply to filament.
+15V	Power for analog components.
-15V	Power for analog components.
GND	Return for power supplies.
ARC GND	Low impedance return path to HVPS for arc currents.

System Controller Board P/N 104668 (SCB)

The system controller board plugs into the electronics card cage. It is the middle board in the card cage (third from the front).

The following functions are provided by the SCB:

Operator Interface:

IR Interface.

RS232 Interface.

On-Screen Menus.

Dot Matrix Display.

Inter Board Communications and Control:

IIC Bus (Overall system control).

Serial Bus.

Power Supply Interface.

Projector operation:

Direct operation of the projector by issuing commands based on external directives and internal information.

Contains program and working memories.

Generate Overlays:

Digital Test Patterns.

Gray-Scale.

Provide Convergence Correction Outputs:

X and Y Axis Correction.

Sensitivity and Threshold Correction.

The block diagram (*see Figure 2-17*) description, along with the I/O description in the section following, provide information to perform module-level troubleshooting.

General Functional Description

The system controller board receives external commands, interprets those commands, and issues internal commands to control the operation of the arc lamp, light valves, raster generation, video signal amplifiers, and other components necessary for projector operation.

The SCB receives commands from the outside world via the IR or RS232 interface. Output communication is accomplished via the RS232, the dot matrix display, and the CRT display.

Control of raster generation by the SCB is limited to primarily controlling geometric and convergence correction while most other raster functions are under local hardware control.

Video signal control involves choosing which video input to use, whether or not to insert overlays, and setting gain and offset values.

The SCB also takes in information on raster and video status from other circuit boards and generates control signals and displays based on that information.

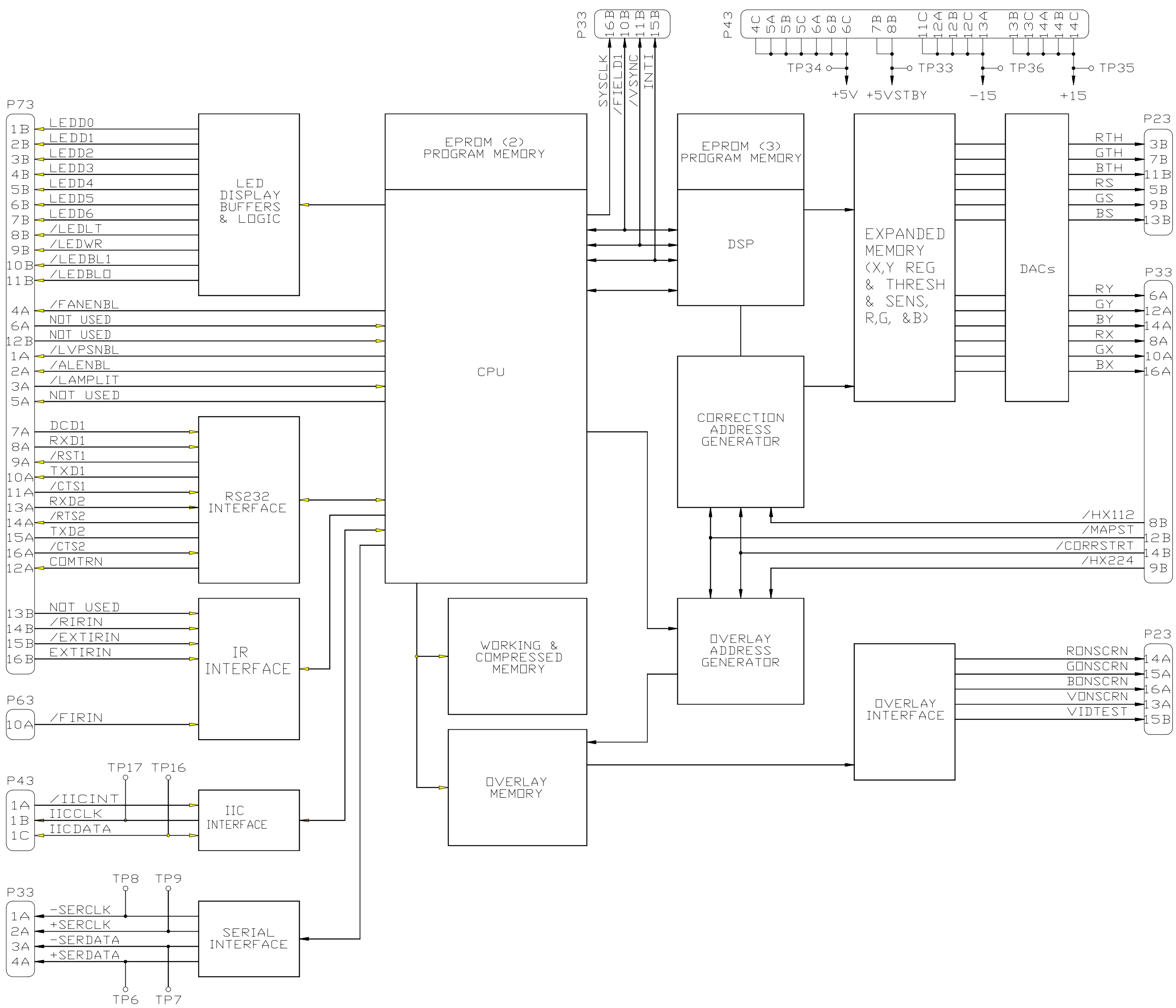


Figure 2-17 System Controller Board, Block Diagram

CPU

The central processor (CPU) is a Motorola MC68302 embedded controller and is the main controlling component of the projector.

Operation of the CPU is controlled by the program instructions written in the Program Memory. The program memory consists of two (2) UV erasable EPROMs (U24 and U63) loaded with the appropriate software for the projector, mounted in sockets for ease of updating the software. The EPROMs, being non-volatile, will maintain their integrity under all operational conditions. Upgrading the program memory is simply a matter of replacing the EPROMs with the newer version.

As the CPU processes information, it is stored in the Working and Compressed Memory. This includes all temporary storage as well as the channel data that the operator sets while 'tweeking up' the projector.

All communication, both input and output, for internal signals and operator interface, is directly controlled by the processor. On-screen messages are generated and written to the Overlay Memory which serves as a video memory for controlling the on-screen display. RS-232 commands are received and sent via the RS-232 interface. IR communications are only received by the projector. No capability for transmitting IR is provided in the projector. The CPU communicates directly with the IR interface to receive commands. The CPU sends status and error codes to the LED interface for display on the dot-matrix display on the rear of the projector. Internal communication is accomplished by the processor sending data via the IIC interface and the serial data interface.

The CPU also directs the operation of the DSP.

Working and Compressed Memory

The Working and Compressed Memory (WCM) consists of four (4) SRAMs, mounted in sockets that provide battery backup which in turn provides the ability to maintain all projector settings even when the projector loses power for extended periods. Although not covered separately by warranty, the battery should be able to maintain the stored data for over one (1) year with no power applied to the projector. With power applied, the battery should remain viable for up to ten (10) years.

WCM is used as working memory for the CPU. All temporary storage of working data during routine CPU operations is done in the WCM. Additionally, the channel data is stored in WCM. There are 29 channels of data that can be stored in the projector. Channel data is all of the information that is stored that is specific to a particular projector channel. For example, the Position settings for R, G, and B, the ILA frequency, X convergence correction, Sensitivity correction, etc. As well as the channel data, global data is also stored in the WCM. This includes anything that is not channel specific such as auto-select groups, timers, and status logs. As long as the battery backup remains viable or power is applied to the projector, the WCM will remain intact. However, if data is corrupted for any reason, such as removing one (1) of the four (4) memory chips or a battery losing power while the projector is not plugged in, all of the data in the WCM will be lost. For this reason, it is always a good idea to back up the channel data to an external data storage medium.

Expanded Memory

The Expanded Memory (EXM) is composed of twelve (12) memories. Each of these memories stores information that will be used to correct the raster for both shading and convergence.

The digital information that is to be used for raster correction is stored in bit-map form. The bit-map is 96 fields (out of 112) wide by the number of horizontal lines in a frame wide. Each address in the EXM corresponds to a small section of one (1) line on the screen.

As the raster is scanned, the EXM is being read out so that during the time that each line of the raster is being scanned, 96 memory locations are being read. In this way, each area of the raster can be accurately corrected.

Since there are twelve (12) functions to be corrected (R, G, and B for each of X registration, Y registration, Threshold, and Sensitivity), each memory corresponds to one correction function. All twelve (12) memories are read out simultaneously, one (1) address at a time, to provide the correction required for the raster.

Correction Address Generator

The Correction Address Generator is used to address the EXM during both load and readout. During the loading time, when the DSP is writing to the EXM, the DSP controls the address generator, both setup and timing. During the time when writing is not occurring, the memory is being read. At that time, the address generator is set up by the DSP, but it's timing signals come from the RTG to synchronize it with raster generation.

During the read times, the address generator uses the /CORRSTRT and /MAPST signals from the RTG as timing signals. The timing clock used is the /HX112 signal. Thus, the address generator generates addresses at the rate of 112 times the horizontal frequency. It does this for 96 clock pulses, then stops. After the next /CORRSTRT signal, it generates another 96 addresses. This repeats for each line in the raster. The starting address is timed by the /MAPST signal. When that comes along, it indicates the top of the raster is beginning so the address generator should begin counting at the beginning.

During writing times, as the DSP generates data, it causes the address generator to increment to the proper address to be loaded.

DACs

The Digital to Analog Converters are used to convert the digital data stored in the EXMs to analog form for use by the correction amplifiers. There are twelve (12) DACs, one (1) for each memory. Six (6) of the DACs are for X-Y registration and send their outputs to the VDB. The other six (6) DACs are for shading (Threshold and Sensitivity) and send their outputs to the VPB. The data from the DACs is real time data that corrects the raster as it is scanned.

DSP

The Digital Signal Processor is a slave processor that operates under the control of the CPU. The DSP does the processing that converts the raw convergence and shading numbers that the operator inputs, into the smooth correction data that drives the correction amplifiers. The raw (compressed) data is stored in the WCM while the smooth (expanded) data is stored in the EXM.

When a channel change occurs in the projector, the compressed correction data that is stored in the WCM is interpolated by the DSP into the expanded form that is stored in the Expanded Memory.

The compressed data is stored in the WCM in a 33X33 matrix of values representing the desired correction over the whole screen. For each channel, there are twelve (12) of these matrices stored in the WCM; one (1) for each color of each function (R, G, and B for each of X registration, Y registration, Threshold, and Sensitivity).

Overlay Memory

All display that does not originate from the external source is called Overlay and includes on-screen text and test patterns. In order to produce overlays, a bit-map must be generated that can be read out as the raster is being produced by the projector’s deflection circuits. This bit-map tells what to show on the screen at any point at any time. The CPU generates the bit-map and stores it in the overlay memory for readout during raster scanning. When there is no overlay to be presented, there is nothing but external video to show. That information is also stored in the overlay memory.

The Overlay Memory is composed of two SRAMs. They are not battery backed since they store no data that must be held while the projector is not in operation. The Overlay Memory is used to store the bit-mapped information that describes the overlay pattern that is seen on the faces of the CRTs, hence on the screen. The overlay bit-map is 192 fields wide (out of 224) by the total number of raster lines. Each of these memory locations stores information that determines what will be displayed at that particular point on the screen. These choices are full bright or black for each color individually, gray scale for all three (3) colors together, or external video for all three (3) colors.

Overlay Address Generator

The Overlay Address Generator is used to address the overlay memory in a manner similar to how the correction address generator addresses the EXM during both load and readout.

The CPU controls the operation of the Overlay Address Generator while writing to the overlay memory. During the read times, as with the correction generator, the overlay address generator uses the /CORRSTRT and /MAPST signals from the RTG as timing signals. However, the timing clock used is the /HX224 signal. This is because the generator must run at 224 times the H frequency in order to be able to generate the 192 addresses required for each line of overlay.

The addresses are generated for 192 clock pulses then the generator pauses. After the next /CORRSTRT signal, it generates another 192 addresses. This repeats for each line in the raster. The starting address is timed by the /MAPST signal. When that comes along, it indicates the top of the raster is beginning so the address generator should begin counting at the beginning.

Overlay Interface

The Overlay Interface takes the raw data out of the Overlay Memory and sends formatted information to the VPB for generating the desired displays. Some of the data is simply buffered and sent along. That data is the information regarding the full brightness and external video that produces everything but greyscale and dots. The greyscale, dot, and pyramid patterns must first be decoded by a D to A. After conversion to analog and appropriate filtering, the information is sent out to the VPB as the VIDTEST signal.

LED Display Buffers and Logic

The LED dot matrix display is located on the rear of the projector just under the video and sync input connectors. In that location, it is not physically located on the SCB but it is directly controlled by the CPU with connection via the backplane.

The Dot Matrix Display is used for displaying operational and error codes. These codes will assist in troubleshooting and verifying proper operation. The Dot Matrix Display receives its data from the CPU via the display buffer.

RS232 Interface

The RS232 Interface is a bi-directional communications port. The interface protocol is RS232 with two (2) ports; one (1) port being fully functional with the other having more limited use.

The Terminal In port is the fully functional port. It is used for communicating with the projector using a VT100 or similar terminal emulator. The terminal allows accessing all functions available on the projector. In addition, using the terminal provides the user with continuously updated status data. The bi-directional port allows third-party controllers to be used to control the projector using ASCII character control codes.

The Terminal Out port is also RS232 but has limited functionality. It is used primarily for attaching a switcher to the projector to allow for smoother switching of sources.

IR Interface

The IR Interface is a receive-only interface. There is no capability to transmit information out of the projector over the IR interface. The user must depend on the on-screen information and LED Dot Matrix displays to verify operation of the projector.

There are three (3) ports for receiving IR radiation. One (1) is located on the front of the projector just above the Green projection lens and the other two (2) are located on the rear panel. One of the receivers on the rear panel is located next to the LED display and, like the front receiver, is used for directly receiving IR radiation. The other rear-mounted receiver is used for connecting an IR repeater, which is an optional device that allows the user to control the projector from up to 150 feet away.

The IR receivers are not located on the SCB but are directly controlled by the CPU and are connected via the backplane.

IIC Interface

The IIC Interface is used to transfer operating data to the circuit boards. IIC is a protocol for a chipset made by Phillips. It is a bi-directional serial communications interface. The IIC uses three (3) lines for communications: a clock line (IICCLK), a data line (IICDATA), and an interrupt line (/IICINT). The SCB is the master when communicating over the IIC with the other circuit boards being slaves. The SCB sends information to another board by sending an address then data. When the circuit boards have information to communicate to the SCB, an interrupt is generated.

The SCB polls the boards to see who sent the interrupt. The SCB then reads the information from the IIC bus.

One primary use of the IIC in the projector, in addition to its use as a data transfer device, is control of the differential serial communications bus.

Serial Interface

The Serial Interface is a differential communication bus used for transferring data quickly from the SCB to the other boards. It is unidirectional. In order for any board to receive a packet of data via the Serial Interface, it must first be commanded to receive that data by the IIC interface. Then the data is sent over the differential bus to the receiving board. Once a packet of data has been sent, the IIC must again be used to allow another packet to be received.

General I/O

This section describes the inputs to and outputs from the SCB. The I/O descriptions are arranged by the source/destination of the signal. The assemblies communicated with are the primary heading of each group of signals and are further subdivided into inputs and outputs. In each case, the signal's direction is noted, with input referring to an input *to* the SCB, and output to an output *from* the SCB. (e.g. under Raster Timing Generator; 'Input'; /MAPST refers to the signal /MAPST that is an *input* to the SCB from the Raster Timing Generator Board). Any test points provided are noted.

Table 2-12 System Controller Board I/O Signals

Video Processor Board	
I/O	**Description**
IICDATA	Data line for transferring the following information (I = input, O = output). The input data are associated with an interrupt pulse. I VIDOK I SWEEPOK I BEAMDET O BENABLE O GENABLE O RENABLE O CH1SEL O CH2SEL O SLOAD O VERTICAL FREQUENCY

Input	Description
/IICINT	Interrupt used to tell the SCB that the VPB has data to report.

Video Processor Board	
Output	**Description**
IICCLK	Clock signal for IIC data bus.
+SERCLK	Serial data transfer clock.
-SERCLK	Serial data transfer clock.
+SERDATA	Serial data transfer. Used to transfer the following command data: REDBIAS, GRNBIAS, and BLUBIAS to control the bias on the three (3) ILA®s respectively, RCONT, GCONT, and BCONT to control the contrast for the three CRTs, and BRIGHT to control the brightness for all three CRTs.
-SERDATA	Serial data transfer.
BONSCRN	Output from the overlay interface used to turn blue overlay on and off.
RONSCRN	Similar to BONSCRN.
GONSCRN	Similar to BONSCRN.
VONSCRN	Output from overlay interface used to turn external video on and off.
VIDTEST	Video signal output for gray-scale. Real time data at 0V to 1V.
RSENS	Sensitivity output from the DAC at 0V to 1V with 140 ohm Zout.
GSENS	Similar to RSENS.
BSENS	Similar to RSENS.
RTHRESH	Threshold output from the DAC at 0V to 1V with 140 ohm .
GTHRESH	Similar to RTHRESH.
BTHRESH	Similar to RTHRESH.

Raster Timing Generator	
I/O	**Description**
IICDATA	Data line for transferring the following data (I = input, 0 = output). The input data are associated with an interrupt pulse. O Priority Select I /Sync Select I Internal Sync I Horizontal Count I /Phase Lock I INTI O Vertical Flyback Start Delay O Map Start Delay O L Blank O R Blank O U Blank O D Blank O /STBP O DC Restore Delay I Phase Count I Correction Delay I Pincushion Start Delay

Input	Description
/IICINT	Interrupt used to tell the SCB that the RTG has data to report.
/FRAMEST	Timing pulse Indicating the beginning of a frame. Used in the SCB for counting vertical frequency. (TP5)
/MAPST	Signal used to start the correction and overlay address counters during each vertical sweep. (TP12)
/Hx112	Clock pulse at 112 times the horizontal frequency. Used for convergence and Z-axis correction map generation. (TP20)
/Hx224	Square wave signal 224 times the horizontal frequency for overlay map generation, horizontal map correction start, left and right blanking, DC restore, and other timing functions. (TP23)
/FIELD1	TTL level indicating which field of an interlaced frame (Low if non-interlaced. (TP8)
/CORRSTRT	Signal used to start the convergence and overlay address generators during each horizontal sweep. (TP4)
INTI	Indicates when input source signal is interlaced. (TP2)
/VSYNC	Regenerated vertical sync signal, pulse-shaped to 3 horizontal lines in width. (TP21)

Output	Description

SYSCLK	4.05MHz clock signal
IICCLK	Clock signal for the IIC data bus.
+SERCLK	Serial data transfer clock.
-SERCLK	Serial data transfer clock.
+SERDATA	Serial data transfer.
-SERDATA	Serial data transfer.

Vertical Deflection Board	
I/O	**Description**
IICDATA	Data line for transferring the following data (I = input, O = output), the input data are associated with an interrupt pulse. **I** SLOAD

Input	**Description**
/IICINT	Interrupt used to tell the SCB that the VDB has data to report.

Output	**Description**
IICCLK	Clock signal for the IIC data bus.
+SERCLK	Serial data transfer clock.
-SERCLK	Serial data transfer clock.
+SERDATA	Serial data transfer. Used to transfer the following command data: VH+, VH- to control the vertical amplitude (height) VCENTRED, VCENTGRN, VCENTBLU to control vertical centering of the red, green and blue rasters respectively; TRAPCORR to control keystone correction; LRPNCORR for left and right pincushion correction; TBPNCORR for top and bottom pincushion correction; HLINCORR for horizontal linearity correction.
-SERDATA	Serial data transfer.
RXCORR	Horizontal correction output from DAC with 140 ohm Zout.
RYCORR	Vertical correction output from DAC with 140 ohm Zout.
GXCORR	Similar to RXCORR.
GYCORR	Similar to RYCORR.
BXCORR	Similar to RXCORR
BYCORR	Similar to RYCORR.

Horizontal Deflection Board	
I/O	Description
IICDATA	Data line for transferring the following data (I = input, O = output). O Flyback Switch Select O Flyback Switch Pulse I Front/Rear indication I Floor/Ceiling Indication O Serial Data Load

Input	**Description**
/IICINT	Interrupt that tells the SCB that the HDB has data to report.

Horizontal Deflection Board	
Output	**Description**
IICCLK	Clock signal for the IIC data bus.
+SERCLK	Serial data transfer clock.
-SERCLK	Serial data transfer clock.
+SERDATA	Serial data transfer. Used to transfer the following command data: HPHASE to control the horizontal phase, HLINR to control the horizontal linearity, HCENTBLU, HCENTGRN, HCENTRED to control the horizontal centering of the blue, green and red rasters respectively, and WIDTH to control the horizontal width of all three rasters and for control of geometric correction.
-SERDATA	Serial data transfer

System Power Supply	
Inputs	**Description**
+5.0V	Power for digital components
+5V STB	Power to CPU and peripherals
+15V	Power for analog components
-15V	Power for analog components
/LAMPLIT	Indicates normal operating voltage being supplied to Arc Lamp

Output	**Description**
/LVPSNBL	Low Voltage Power Supply Enable
/FANENBL	Signal to enable 24V Standby Power
/ALENBL	Enables Arc Lamp Power

Dot Matrix Status Display	
Outputs	**Description**
LEDDO-6	Data
/LEDLT	Lamp test
/LEDWR	Write

/LEDBL1	Brightness
/LEDBLO	Brightness

RS-232 Interface Signals		
RS232 #1	RS232 #2	Description
RXD1	RXD2	Receive data
TXD1	TXD2	Transmit data
/CTS1	/CTS2	/Clear to send
/RTS1	/RTS2	/Ready to send
DCD1		Carrier detect
COMRTN		Return

IR Interface	
Input	**Description**
/RIRIN	Input from rear IR Receiver
/EXTIRIN	Differential input from IR Receiver
EXTIRIN	Differential input from IR Receiver
/FIRIN	Input from front IR Receiver

Backplane Board p/n 100571

The Backplane is a PCB that serves as an interconnecting point for the tethered and IR remotes, power supplies, CRTs, Yokes, ILA® assemblies, PCBs and external video. The Backplane does not modify signals in any way—it merely provides an interfacing point for most of the wiring in the projector in lieu of cabling. Refer to Figure 2-18 for a general idea of how the wiring is interconnected in the projector.

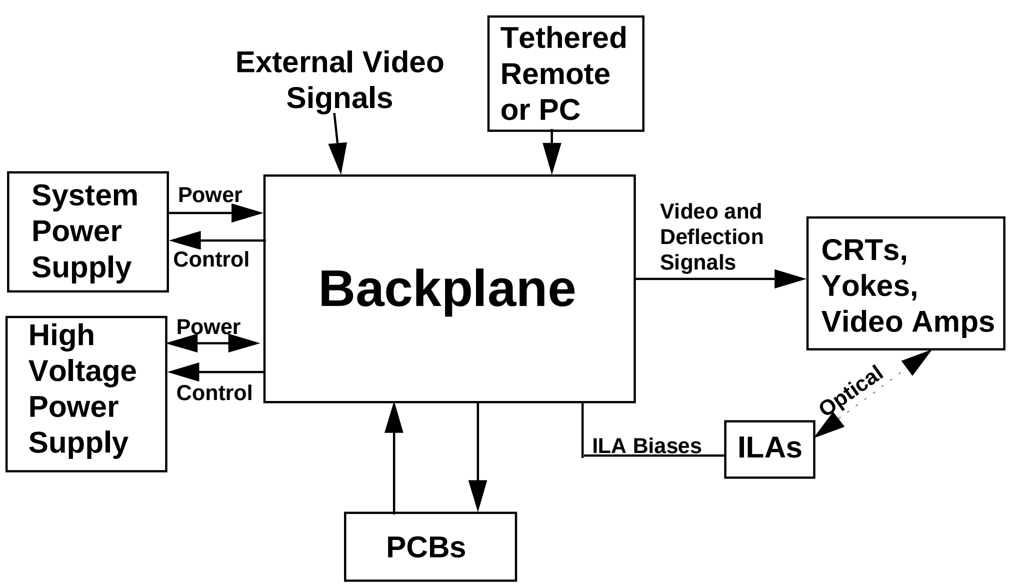


Figure 2-18 Backplane Interface Block Diagram

2.7 Optical Section

The Optical section consists of the CRT Assembly, the Arc Lamp Assembly, and the Optical subassemblies, which provides the image to be viewed on the screen. The Optical Section filters, splits and directs the high intensity light to the three (3) separate (RGB) light channels. Figure 2-19 shows the video path from the CRT to the screen and the optical path from the Arc Lamp to the screen.

CRT Assembly

The image in the projector begins at the three (3) CRTs. The CRT Assembly is located beneath the main electronics card cage and contains three (3) sets of the following:

CRT tubes.

CRT cooling assemblies.

CRT Yokes.

Yoke clamps.

Video Amplifier Boards.

Each CRT has a high resolution infrared beam and a high resolution phosphor screen. Fans mounted at the rear of the assembly cool the CRT Assembly. Procedures for adjusting the yokes and the width coils can be found in Section.3.2. A functional description of the Video Amplifier Boards is provided in Section 2.6.5.

Relay Lens

The relay lens picks up the CRT image from the face of the CRT and focuses the image to the ILA® assembly.

Image Light Amplifier (ILA®) Assembly

At the same time as the image is received at the input side of the ILA® assembly, the output side of the ILA® assembly is receiving high intensity light from the arc lamp through the prism. This high intensity light is then phase modulated (altered) by the video signal from the input side of the ILA® assembly and then reflected back out of the output side and then travels through the prism to be picked up by the projection lens.

NOTE: The prism reflects horizontally polarized light and passes vertically polarized light. Light from the arc lamp is polarized horizontally and reflects from the prism into the ILA® assembly then back out again, after being phase modulated 90° to vertical by the Liquid Crystal layers into vertically polarized light. The vertically polarized light then passes through the prism to the projector lens. The ILA® assembly combines the input signal from the CRT with the high intensity light from the arc lamp. Thus, the brightness of the screen image does not depend on the brightness of the CRT but on the light from the xenon arc lamp. (A more detailed explanation of the ILA® assembly is in Section 2.8 at the end of this chapter.)

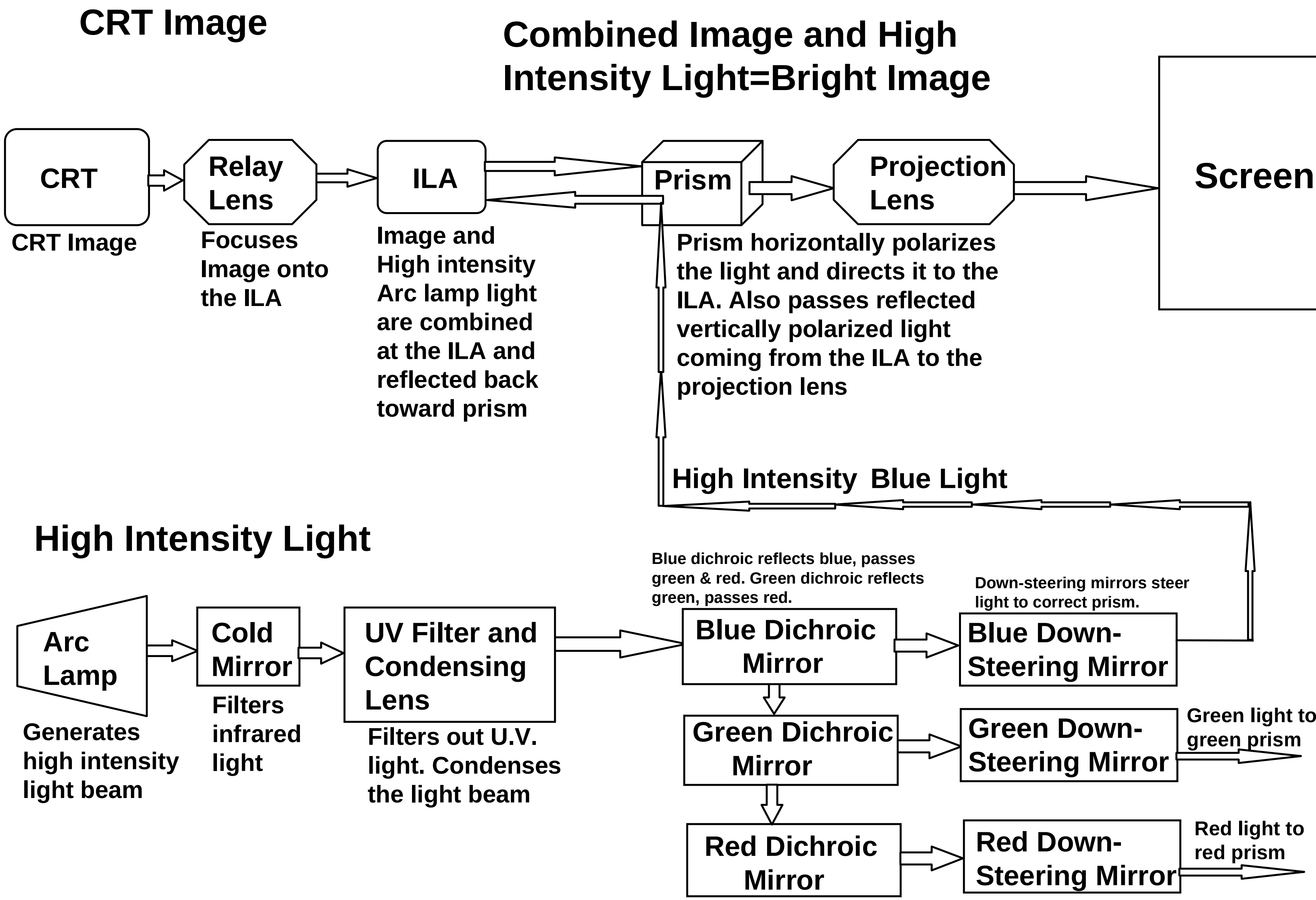


Figure 2-19 Optical Block Diagram

Prism

The prism receives the high intensity light from the xenon arc lamp and polarizes the light horizontally. The prism reflects virtually all of this light toward the ILA® assembly. This light is then phase modulated into a vertical plane by the input side of the ILA® assembly and then reflected back toward the same prism. Since the prism reflects only horizontal light and passes vertical light, this high intensity, vertically polarized image goes straight through the prism and into the projection lens.

Projection Lens

The projection lens picks up the high intensity image from the prism and transmits it to the projector screen. The projection lenses are individually mounted so they can be focused and aligned separately. The green lens is fixed horizontally and the red and blue lenses allow horizontal movement to align them with the green lens. Various focal lengths, (focal length = throw distance/screen width), are available for different sized rooms and screens.

Arc Lamp Assembly

The high intensity light from the Xenon Arc Lamp produces a “full screen” output of between 3,000 and 6,800 lumens, depending on the model of projector. The output from the arc lamp, along with the output from the ILA® Assemblies, produces the images on the screen.

NOTE: To protect equipment and personnel against explosion hazard, the arc lamp is covered with a safety glass plate and is mounted in a protective metal housing. This housing provides protection and ensures accurate alignment of the arc lamp optical axis with the projector housing by means of machined surfaces and precision alignment pins.

The Arc Lamp itself, a gas-filled device, maintains a relatively constant voltage. It, therefore becomes the voltage controlled device and the SPS Arc Lamp supply controls the current to the lamp. The constant voltage maintained by the lamp and the constant current provided by the SPS result in a constant power supplied to the Arc Lamp.

The arc lamp and reflector housing is never disassembled in the field. The arc lamp is replaced by exchanging the complete assembly.

The Arc Lamp Assembly also includes the Ignitor and its circuitry. The Ignitor circuit provides a momentary high voltage that excites the xenon gas inside the Arc Lamp. After the arc lamp is struck and turns on, it is maintained by a high-current, low-voltage power supply.

Optical Subassemblies

Cold Mirror

The Cold Mirror lets most of the infrared light pass through and reflects the rest of the light toward the prism through an ultraviolet filter/condensing lens, dichroic mirrors and down-steering mirrors.
The infrared light is absorbed in a series of fan-cooled screens.

CAUTION! Cold mirrors absorb IR light and can get very hot!

Ultraviolet Filter and Condensing Lens

The arc lamp light beam reflected off the cold mirror passes through the Ultraviolet Filter/Condensing Lens that removes most of the Ultraviolet light and condenses the light beam. Therefore, most of the infrared and ultraviolet light is filtered out before the beam enters the more sensitive portions of the optics, leaving only the visible portion. Without these filters, the infrared light would overheat the prisms and the ILA® assemblies, and the ultraviolet light would damage the ILA® assemblies and be hazardous to personnel.

Dichroic Mirrors and Down-Steering Mirrors

The condensed light beam strikes the first dichroic mirror that is designed to pass red and green light but reflect blue light. The blue light is reflected to a down-steering mirror which reflects it again directly to the prism in the blue system. The red and green light travel on to the next dichroic mirror that passes the red light and reflects the green light to the down-steering mirror and prism in the green system. The red light travels on to the last Dichroic mirror which reflects the remaining red light to the last down-steering mirror and prism in the red system. Each of these three (3) light beams independently combines with the video image in their own (red, green or blue) color systems at the ILA® assemblies as described above.

CAUTION! Do not attempt to realign any mirrors. They require the use of a complex laser beam alignment fixture.

2.8 Image Light Amplifier

A closer examination of the output side of the ILA® assembly as illustrated in Figure 2-20 helps in understanding its operation.

Visible light from the arc lamp passes through dichroic mirror assemblies and is then reflected into a prism assembly that polarizes the light horizontally. The horizontally polarized light is sent through the liquid crystal layer of the ILA® assembly, reflected by a dielectric mirror surface, and then sent back through the liquid crystal layer on the way out of the ILA® assembly.

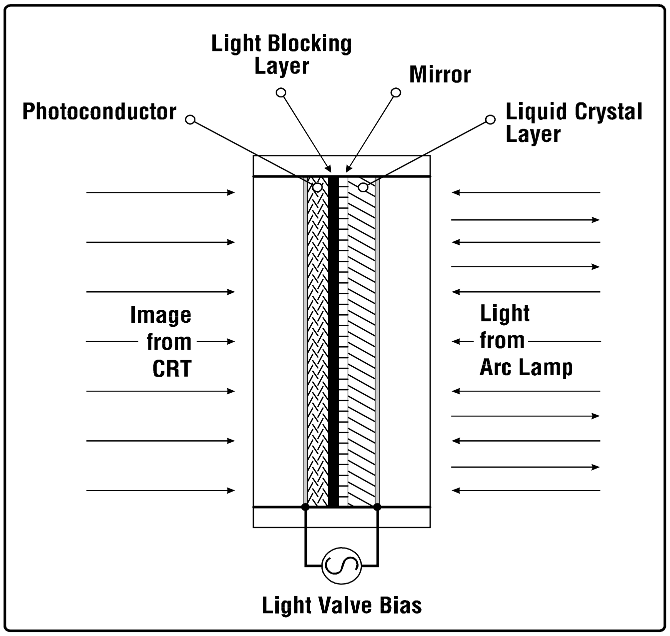


Figure 2-20 The Hughes-JVC Image Light Amplifier

The polarized light is phase modulated, or rotated, up to 90º by the liquid crystal layer; 45º of rotation for the first pass through, and another 45º after being reflected by the internal mirror.

The axis of the polarized light is proportional to the brightness on the input side of the ILA® assembly. For example, when the photoconductor on the input side is not illuminated, the liquid crystal does not rotate the polarized light from the arc lamp. Conversely, when the input side is fully illuminated, the liquid crystal rotates the polarized light a full 90º from a horizontal direction to a vertical direction. Ninety-nine percent (99%) of the light energy entering the ILA® assembly is reflected.

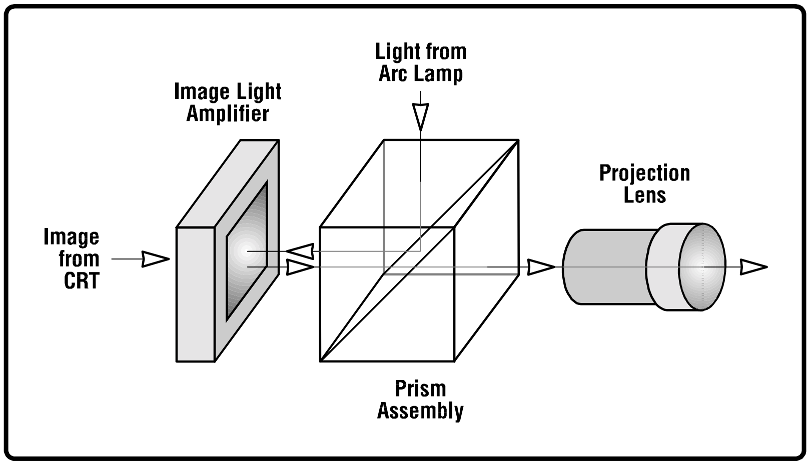


Figure 2-21 Simplified illustration of the Series 300 Projector optical path

The phase modulated light exiting the ILA® assembly re-enters the prism assembly that, in this direction, passes vertically polarized light to the projection lens and onto the screen. Horizontally polarized light re-entering the prism assembly is rejected. Light that is not fully horizontally or vertically polarized will pass through the prism assembly in varying degrees of brightness.

3.0 Service Adjustments

Contents

3.1 Service (Cover-Off) Power-On Sequence

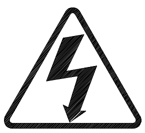
Before applying power to the HJT Model 330, 340SC and 370SC Projector, verify that the projector is connected to the correct power source (refer to Table 0-1 in the Safety chapter). If there is any visible damage to any of the cables do not power on the projector until the damaged cable is replaced.

To turn on projector power:

1. If using a terminal or tethered remote control, connect one or the other to the input jack marked "Terminal In" on the rear panel of the projector card cage.
2. Remove the rear cover from the projector.

CAUTION! If the projector has been operating, and the rear cover must be removed, be sure to set the power interlock switch (top right as shown in Photo 3-1) to the UP position immediately and turn the projector back on with the remote. Then turn the projector power back off with the remote. This allows power to be reapplied to the fans to cool the arc lamp that remains very hot even after power is removed. During a normal power shutdown the fans continue to run for several minutes to cool the arc lamp.

3. Turn on the main circuit breaker (located on the bottom, right side of the main power supply inside the projector in (*see Figure 3-1*). This switch turns on the +5V standby power supply for the main processor.
4. Replace the rear cover on the projector or set the power interlock switch, on top of the system power supply, to the full UP position (*see Figure 3-1*).



WARNING!!! With the cover off the projector, be careful not to touch any open parts of the projector. Be particularly careful of any high voltage wires (large, red wires) which although heavily insulated could still cause severe electrical shock if the insulation is pinched or damaged. **NEVER** look into the Xenon Arc Lamp light path or directly at any of the projection lens light paths-the light intensity is strong enough to cause injury to eyes.

NOTE: If using a tethered remote or a terminal for projector control, an active display should now appear on the LCD or screen. This is the Standby Power mode. The projector is now ready for a power "ON" command.

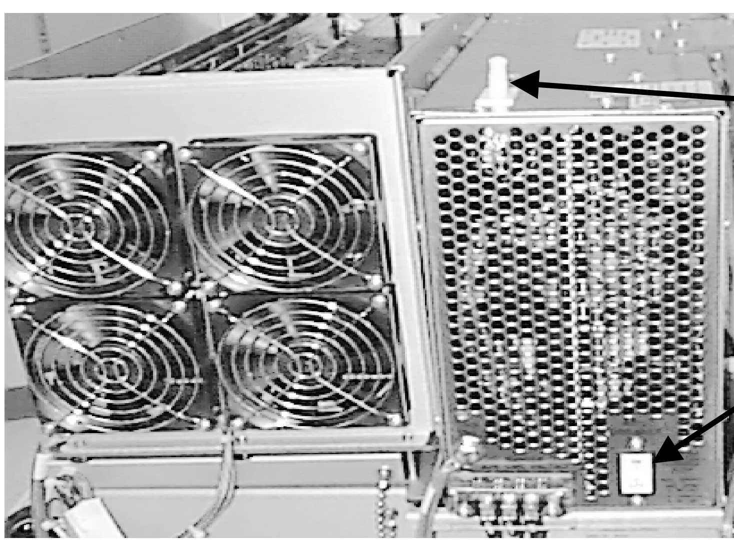


Figure 3-1 Power Interlock Switch and Main Circuit Breaker.

1. Press the Power ON key to turn on the projector (press both power keys simultaneously if using the tethered remote). The Ignitor circuit will ignite the arc lamp and power will be applied to the electronics system.

   NOTE: If using a terminal or PC, turn full power on by typing CTRL-P. To power up the electronics only, type CTRL-E. To power up the lamp only, type CTRL-L. These are toggle commands; repeated issuance of the commands toggles these power sources on and off. The lamp and electronics cannot be powered up separately with the remote controls.

3.2 CRT Yoke Rotation

The CRT deflection yokes are factory set. If the CRT image is not level, adjust the individual CRT deflection yoke as required (see Figure 3-1).

WARNING!!! To prevent possible electrical shock when performing the yoke rotation, always wear ANSI/ASTM 10,000 volt rated safety gloves for protection from high yoke voltages present. Ensure the gloves are not cracked!

To adjust the deflection yokes:

2. Press TEST 2 to display the White X-hatch pattern.
3. Cutoff R and B and view G.
4. Remove the rear projector cover (see Section 4.2).

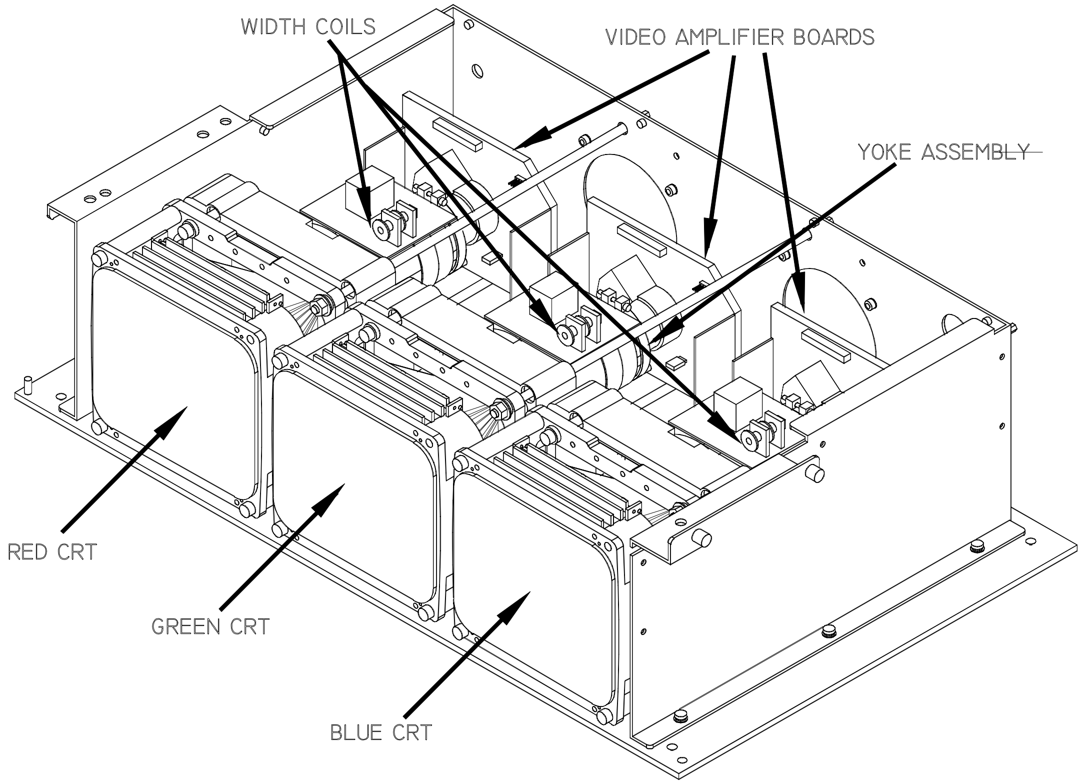


Figure 3-2 View of the CRT Assembly showing deflection yokes, width coils, CRTs and Video Amplifiers.

5. Remove the 2.5mm Allen screw holding the electronics module in place and tilt the electronics module (see CAUTION following) back to expose the CRT necks and yoke.

CAUTION! Remove anything plugged into the rear electronics jacks or the plugs could be badly damaged when the electronics module is tilted back.

6. While observing the center horizontal line on the grid pattern, rotate the green CRT deflection yoke, (the green CRT is in the middle), to achieve a level image at the center of the screen (if necessary, loosen the yoke clamp slightly to adjust it).

   NOTE: Whenever adjusting the CRT yoke, push forward on the yoke while rotating it to ensure the yoke remains properly positioned on the CRT.

7. View R.
8. Rotate the red CRT deflection yoke (on the right of the projector–from the rear) to achieve a level image at the center of the screen (it should be parallel to the green central horizontal line).

9. View B.
10. Rotate the blue CRT deflection yoke to achieve a level image at the center of the screen (it should be parallel to the green and red grid center lines).
11. Retighten the yoke clamp so it is secure. Be careful not to over-tighten it.
12. Tilt the electronics module back into place.
13. Replace the allen screw from Step 4 above.
14. Replace the rear cover.
15. After Yoke rotation, re-adjust Geometry, Convergence and CRT Mechanical focus.

3.3 Vertical Size Tracking

If the R or B vertical size does not match G, adjust the R and B vertical size pots on the Vertical Deflection Board (see Figure 3-2).

NOTE: The tracking pots are factory adjusted and should **not** normally need adjustment. The Green Vertical Size control (R-228) in particular, should **not need** to be adjusted unless the Green Yoke or Green CRT has been replaced. If the Green Vertical Linearity is off, however, it should be adjusted. In this case, Green should then be matched to Red and Blue.

- ➨ The Red Vertical Size control is R-428.
- ➨ The Blue Vertical Size control is R-328.

To adjust the vertical size controls:

1. Press Test 2 to display the White X-hatch pattern.
2. Remove the rear projector cover.
3. Remove the eight screws holding the electronics module cover and remove the cover.
4. From the Convergence menu select #3, CLEAR CONVG AXES.
5. Position R and B over G (using the POS and arrow keys on the remote–refer to Section 4.9) so that the R and B lines at the outer edges have the same amount of error.
6. Adjust R328 and R428 so that the Red and Blue vertical sizes match the Green vertical size.
7. If unable to match Red or Blue to Green, adjust Green to match the smallest color.
8. Replace the electronics module cover.
9. Replace the rear projector cover.

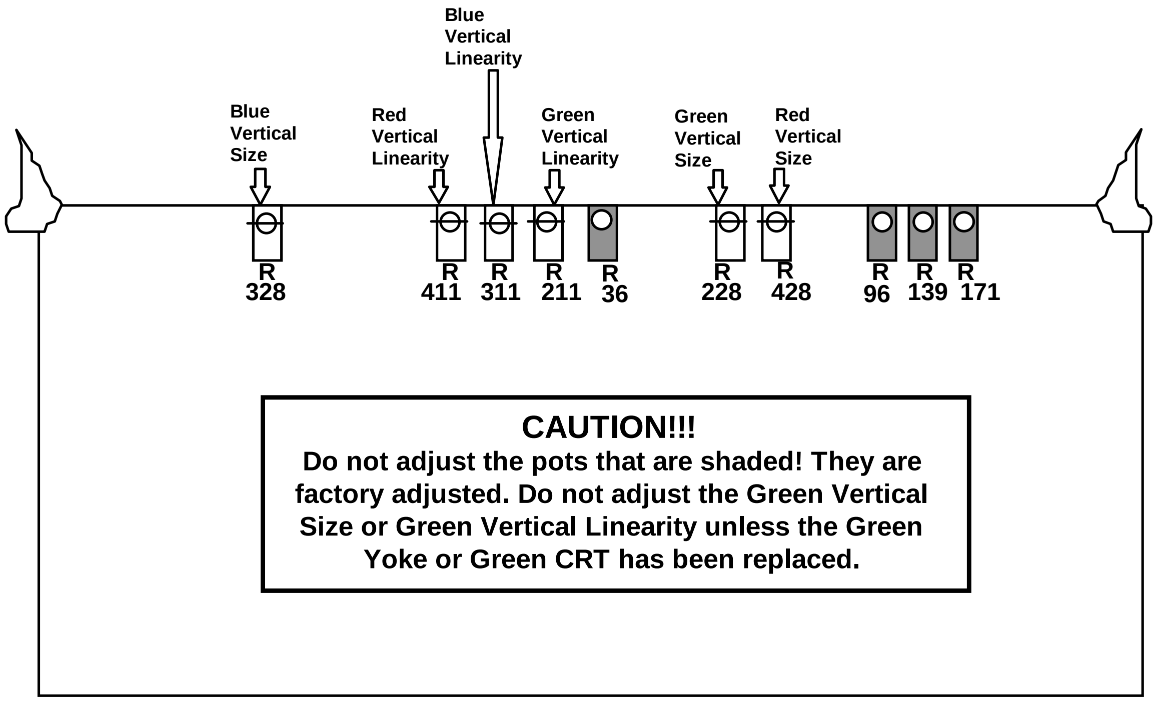


Figure 3-3 Vertical Size and Linearity Controls on the Vertical Deflection Board.

3.4 Vertical Linearity Tracking

If the vertical linearity is not completely linear, use a small slot screwdriver and adjust the vertical linearity controls on the Vertical Deflection Board (refer to Figure 3-2).

NOTE: The Vertical Linearity pots are factory adjusted and will **not** normally need adjustment. The Green Vertical Linearity pot (R-211) in particular, should **not need** to be adjusted unless the Green Yoke or Green CRT has been replaced. If the Green Vertical Linearity is off, however, it should be adjusted.

To adjust vertical linearity:

1. Select Test Pattern 2.
2. Remove the projector cover.
3. Remove the electronics module cover.
4. View Red over Green and position Red (use the POS control and the arrow keys on the remote) so that the Red lines at the edge match the Green lines.
5. Adjust the Red Vertical Linearity pot R-411 so that Red linearity matches Green.
6. Repeat the same procedure for Blue (R-311).
7. Replace the electronics module cover and the projector cover.

3.5 Horizontal Size Tracking

The horizontal width coils are factory adjusted and will not normally need adjustment. In general, if the R and B vertical lines are within two (2) crosshatch lines of each other, they can be brought in line with the Convergence procedure. If the R or B horizontal size does not match G within two crosshatch lines, adjust the Horizontal Width coils on the R and B Deflection Yokes (refer to Figure 3-1). The width coils are mounted on a small circuit board on top of the Yoke assembly inside a white ceramic holder and the adjustment is accessed from the opening at the end of the ceramic holder.

WARNING!!! To prevent possible electrical shock when performing the width coil adjustment always wear ANSI/ASTM 10,000 volt rated safety gloves for protection from the high yoke voltages that are present. Make sure the gloves are not cracked.

To adjust the horizontal size tracking:

1. Remove the rear cover and electronic module cover by removing the 2.5mm Allen screw holding the electronics module in place and tilting the electronics module (*see* ***CAUTION!*** *below*) back to gain access to the yoke.

   CAUTION! Remove anything plugged into the rear electronics jacks or the plugs could be badly damaged when the electronics module is tilted back.

2. View G and R.
3. Using the POS and arrow keys, position Red over Green so that each edge of the pattern has the same amount of error. Adjust the Red coil until the edges align.
4. Use a small plastic hex screwdriver to turn the red coil core (the red CRT is on the right side looking from the rear) clockwise or counterclockwise until the Red horizontal size matches Green.
5. Cutoff R and view G and B.
5. Use a small plastic hex screwdriver to turn the blue coil core (the blue CRT is
   on the left side looking from the rear) clockwise or counterclockwise until the Blue horizontal size matches Green.
6. Tilt the electronics module back into place.
7. Replace the allen screw from Step 1 above.

8. After Yoke rotation, readjust Geometry, Convergence and CRT Mechanical focus.

3.6 ILA® Bias Settings

The ILA® Bias settings are factory set and should not normally need adjustment unless specific maintenance has been performed that requires an ILA® Bias readjustment. Avoid readjusting the ILA® Bias settings unless absolutely necessary.

The ILA® Bias settings adjust the electrical bias levels to each ILA® assembly to a "just off" threshold point so that even the smallest incoming light from the CRT makes the ILA® assembly react. When properly set, this adjustment will put each ILA® assembly at the threshold of operation. If not properly set, image black level will be adversely affected and the ILA® assembly won't react properly to incoming light. ILA® Bias adjustments should be done in a darkened room.

NOTE: If the room cannot be darkened enough to set the ILA® Biases using the screen, try holding a piece of paper a few inches from the lens of the color you are adjusting. Adjust the bias in the usual manner while viewing the entire ILA® assembly area on the paper.

Note On Super Contrast Ila® Assemblies

If using optional Super Contrast ILA® assemblies, the High Contrast Compensator may have to be adjusted for each color prior to performing the ILA® bias adjustment. This procedure is required whenever an ILA® assembly is replaced or if the compensator adjustment lever is inadvertently moved.

To set the High Contrast Compensator:

1. Press the HIDE key to mute CRT images.
2. Block the light from the green and blue lenses with the lens caps.
3. Move the front cover forward to provide access to the ILA® assemblies.
4. Disconnect the connector from the top of the red ILA® assembly.
5. Move the Compensator lever (this lever is just in front of the ILA® connector) to the right and left until the darkest level appears on the screen. If a screen is not available use a piece of white paper in front of the lens.
6. Reconnect the connector to the red ILA®.
7. Repeat the above steps for the green ILA® and the blue ILA®. Block the light from the other two lenses each time.
8. Replace the cover.
9. Remove all lens caps

The CRTs will automatically cut off when you enter the ILA® Bias mode. Any light on the screen is being reflected by the ILA® assembly.

To set the ILA® Frequency and Bias levels:

1. Select ILA® Menu, from the Main Menu.
2. Select Frequency Adjust from the ILA® Bias Menu.
3. A frequency of 1.8 kHz is acceptable for general video viewing. A lower frequency (as low as 1.5 kHz) will provide a brighter image but with lower image burn-in. A higher frequency provides higher resolution. For HDTV a frequency of 2.0-2.5 kHz provides higher resolution. Use the up/down keys to adjust the ILA® frequency for the appropriate input source. As a general rule 1.8 kHz works well with most sources.
4. Display the ILA® BIAS MENU again.
5. Select ADJUST, NO VIDEO. Don't attempt ILA® Bias adjustments on Bias W/ Video. This feature is used for factory quality control only.
6. Press GREEN on the remote to select Green. Place lens caps over the Red and Blue lenses.
7. Use the up/down arrows to adjust the Green ILA® Bias until the brightest area of the ILA® image dissappears. Then raise the bias level until the ILA® image just starts to appear on the screen at any point. Finally, slowly lower the bias level again to the threshold point where the ILA® image just disappears.

   NOTE: It's crucial for the optimum operation of the projector to set the bias level to the point where the selected color just begins to appear on the screen. Find the spot on the screen where the active color first begins to get brighter and use that as the reference point. Go below and above this point to find the setting where one (1) click on the UP key causes an increase in brightness and stop at that point. This will insure that the weakest video signal will cause the ILA® assembly to respond.
8. Cover the Green lens and uncover the Red lens. Press RED to select Red.
9. Repeat Step 7 for the Red ILA® Bias.
10. Cover the Red lens and uncover the Blue lens. Press BLUE to select Blue.
11. Repeat Step 7 for the Blue ILA® Bias.
12. Press Enter on the remote to save the settings and exit this adjustment.

   NOTE: The ILA® Bias settings affect other projector settings. When ILA® Bias has been adjusted, verify and readjust, if necessary, all projector adjustments from the appropriate section of the specific model Operator's Manual.

3.7 CRT Mechanical Focus

The CRT mechanical focus is factory set and will normally not need to be adjusted. Whenever a major component (like a CRT or a HVPS) has been replaced or repaired the CRT mechanical focus must be reset. Use Test Pattern 8, H-Grid and observe the corners of the screen. If the corners are all in sharp focus, the mechanical CRT focus should not be adjusted. If the image is not sharp enough, proceed with the CRT mechanical focus adjustment below.

There are three (3) adjustment rods for each CRT making a total of nine (9). The rods are accessed through holes, covered by hole caps, in the base and fan casing at the rear of the projector (see Figure3-3).

The focus rods will be adjusted so that each CRT face is completely parallel to its respective ILA® assembly, (i.e. positioning the CRT screen face planar with the ILA® along the x, y and z axes).

Each CRT has three (3) focus rods; lower-left, lower-right and upper-left. The focus rods for each CRT work as follows (see Figures 3-3 and 3-4).

The lower-left rod adjusts the CRT to ILA® distance (z-axis)
for upper-right corner and overall focus.

The lower-right rod adjusts the bottom position of the CRT

The upper-left rod adjusts left-side position of the CRT.

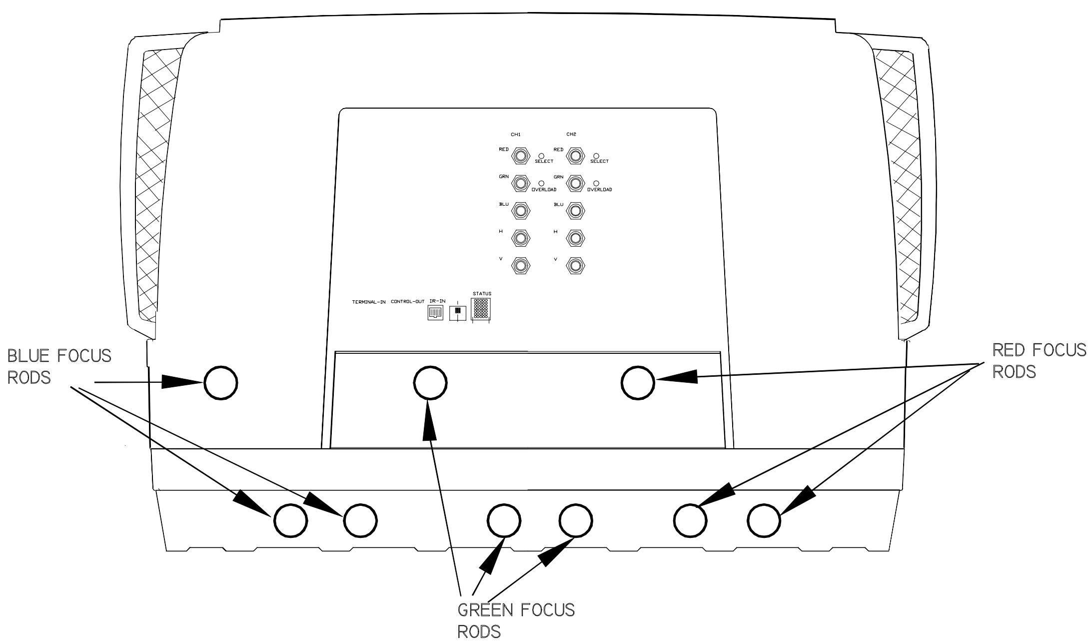


Figure 3-4 CRT Focus Adjustment Apertures. Use a 5mm nutdriver to adjust the focus rods inside the apertures.

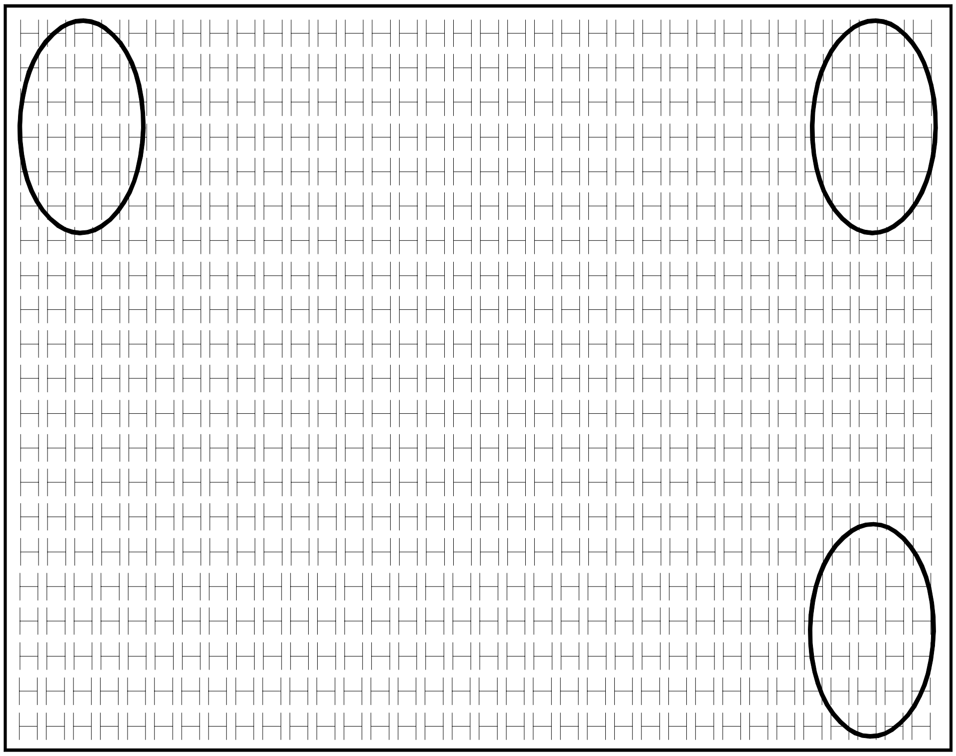


Figure 3-5 On-Screen Focus Points. Adjust the focus rods for best focus at these points.

Using Test Pattern 8, H-Grid, adjust the focus rods for the best mechanical focus as follows:

1. Connect a low-resolution source (approx 31.5 kHz x 60Hz) to the projector inputs so that the projector can sync on that source.
2. Increase Size to 100% horizontal and vertical.
3. Cutoff R and B and view G. Verify G highlighted on the screen.
4. Remove the hole caps to gain access to the focus rods. For the Green CRT, use a 5mm nut driver to adjust the lower-left rod of the Green focus rods (see Figure 3-3). Have another person watch the upper-right corner of the screen for the sharpest focus as you adjust the rod. This focus rod is the CRT z-axis position and affects the overall focus. Observe the upper right corner because it is the pivot point for the other two focus rods.
5. Adjust the lower right focus rod of the Green focus rods and look for the sharpest focus at the bottom right of the screen in the same manner as in Step 2 above.
6. Adjust the upper left focus rod of the G CRT focus rods for the sharpest focus at the upper left of the screen in the same manner as in Step 2.
7. Cut off G and view Red.
8. Repeat Steps 2-4 for Red.

9. Cutoff R and view B.
10. Repeat Steps 2-4 for Blue.

3.8 Electronic Focus

The Electronic Focus adjustment is factory-set and should not need to be adjusted. Whenever a major component has been replaced, like a CRT, or if the high voltage power supply has been repaired the electronic focus will have to be readjusted. To do this, select Test Pattern 8, H-GRID, and observe the screen for a sharp focus at the center of the screen.

If the center appears sharply focused, there is no need to perform the electronic focus. Follow the procedure below if readjustment is necessary.

NOTE: The electronic focus adjustment focuses the electron beam in the CRT. View one color at a time for these adjustments. Recheck the focus of each color because some interaction between R, G and B may occur. The electronic focus adjustment panel is located on the High Voltage Power Supply on the left-rear side of the projector (refer to Figure 3-5).

To adjust the electronic focus:

1. Press TEST 1, Test Pattern 8, H-GRID.
2. Cutoff R and B.
3. Continue with a low resolution source (31.5kHz/60Hz) connected to the projector inputs and Size is at 100% from the previous CRT Mechanical Focus procedure.
4. Using a small plastic screwdriver, adjust the electronic focus for Green and observe the center of the screen. Have another person watch the center of the screen up close while adjusting.

   NOTE: Be careful to adjust the ELECTRONIC FOCUS and not G2. These adjustments are close to each other and one could be mistaken for the other. (Figure 3-5).

5. Cutoff G and view R.
6. Repeat Step 3 for R electronic focus.
7. Cutoff R and view B.
8. Repeat Step 3 for B electronic focus.

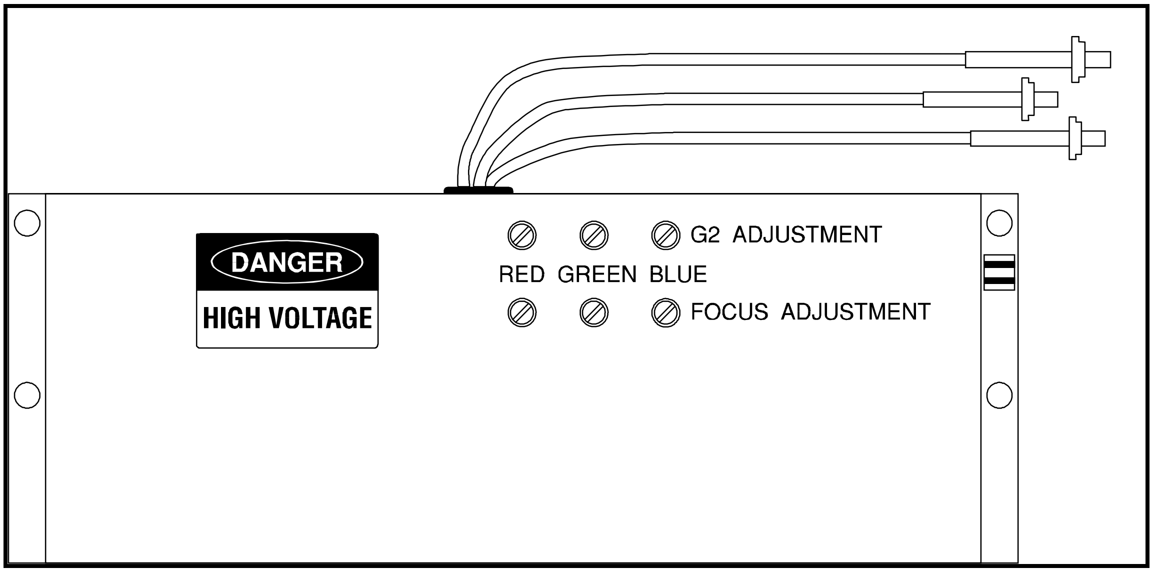


Figure 3-6 Electronic Focus and G2 Adjustments

NOTE: The Electronic focus and G2 adjustments are located on the high voltage power supply on the rear-left side of the projector under the cover.

3.9 Jumper Settings

Table 3-1 illustrates which jumpers are used on the Horizontal Deflection Board and the Vertical Deflection Board for different projector orientations.

Table 3-1 Projection orientation jumper settings.

Orientation	Convergence jumpers Vert. Def. Board	Vertical jumpers Vert. Def. Board	Horizontal jumpers Horiz. Def. Board
Front/Floor Upright Image	J500, J600,J700	J200, J300, J400	J500
Front/Ceiling Inverted Image	J501, J601, J701	J201, J301, J401	J501
Rear/Floor Upright Image	J501, J601, J701	J200, J300, J400	J501
Rear/Ceiling Inverted Image	J500, J600, J700	J201, J301, J401	J500

Front/Rear Jumpers

The Horizontal Scan Reversal Jumper reverses the image projection for front or rear projection. Figure 3-7 illustrates the location of the jumpers on the Horizontal Deflection Board (the board that is furthest from the rear of the projector) and indicates the proper location for front and rear projection. The HJT Series 300 Projector is shipped with the jumper plug inserted in J500 for front projection. For a rear projection setup, insert this jumper plug into J501.

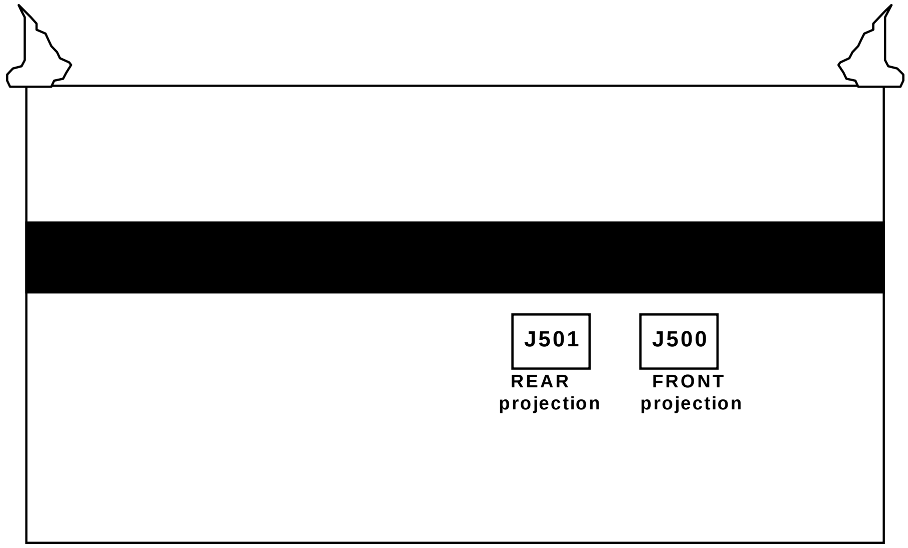


Figure 3-7 Horizontal Scan Jumper and Jacks on Horizontal Deflection Board.

The jumper is installed at the factory in J500 for front projection.

NOTE: When replacing the horizontal deflection board, the Horizontal Deflection Board (P/N 102523) could be damaged if the board is not seated properly on the backplane. This problem usually occurs when the HDB is removed and reinserted after a board failure or when changing the sweep reversal connector. A failure can occur if connector J11 on the HDB (located at the far right when viewing from the component side) does not connect completely with P11 on the backplane.

To ensure a proper connection between J11 and P11 follow the procedure below:

NOTE: Before installing the Horizontal Deflection Board, remove the Vertical Deflection Board. This allows for a full inspection of the proper connection of J11 and P11. The P11 connector on the backplane is slightly loose to allow movement for minor dimensional differences in the position of the J11 connector on the HDB—**Do not tighten** connector P11 on the backplane.

To set the Horizontal Scan Jumper:

1. Turn power off at the projector and wait about five (5) minutes for the arc lamp to cool.
2. Remove the rear cover from the projector.
3. Remove the cover from the card cage.

4. Pull out the Horizontal Deflection board and verify that the horizontal scan jumper is properly inserted for front (J500) or rear (J501) projection, depending on your application (refer to Figure 3-6 and Table 3-1). Change jumper if necessary.
5. Replace the card cage cover.
6. Replace the rear projector cover.

Inverted Vertical Jumpers

The Vertical Invert jumpers invert the image vertically for use in some situations that use mirrors or ceiling projections. Figure 3-7 illustrates the location of the jumpers on the Vertical Deflection Board (the fourth board from the rear of the projector). The Model 330, 340SC and 370SC Projectors are shipped in the normal vertical projection position with vertical jumpers in J200, J300 and J400 and convergence jumpers in J500, J600, and J700. For other orientations, change the jumpers in accordance with Table 3-1.

NOTE: Do not turn projector upside down or at 90º!

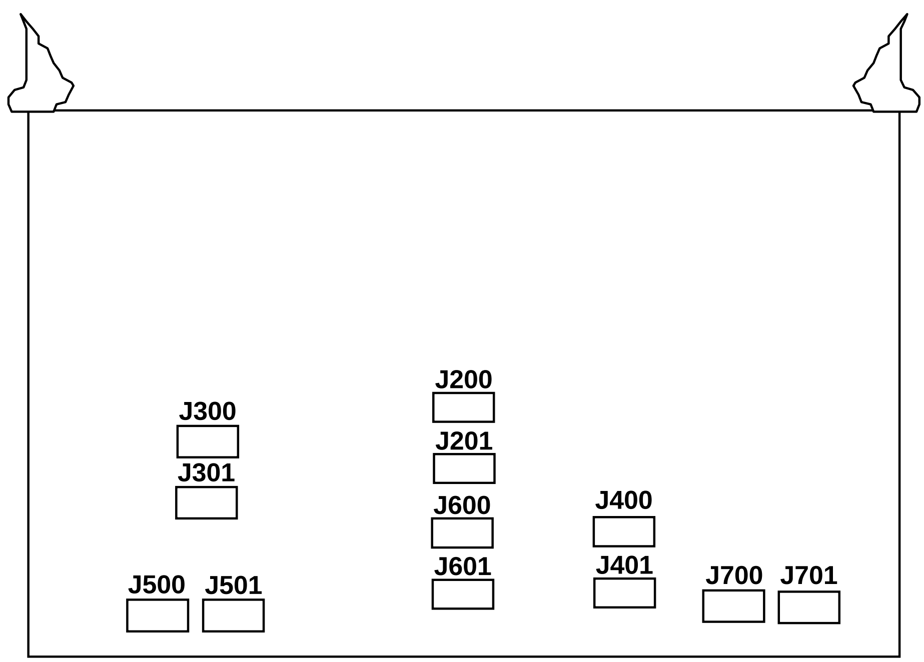


Figure 3-8 Vertical Scan Jumpers on the Vertical Deflection Board.

To change jumpers on the Vertical Deflection Board:

1. Turn power off at the projector and wait about five (5) minutes for the arc lamp to cool.
2. Remove the rear cover from the projector.
3. Remove the cover from the card cage.

4. Pull out the Vertical Deflection Board and verify the vertical jumpers are inserted in the correct jacks, depending on your application (refer to Table 3-1 and Figure 3-7). Change jumpers if necessary.
5. Replace the card cage cover and rear projector cover.

3.10 G2 Adjustment

NOTE: For convenience, HJT provides factory-preset channels. These channels are covered in Chapter 4 of the Operator's Manual. Adjusting G2 affects the image quality of these preset channels. Before adjusting G2, verify that the preset channels can't be used as is. G2 adjustments are located on the High Voltage Power Supply on the left-rear side of the projector. A protective label is placed over the G2 and Electronic Focus adjustments after they are preset at the factory. This label can be punched through with an adjustment screwdriver or removed by a qualified technician.

G2 needs to be reset only when:

- ▼ A major component like a CRT; or ILA® has been replaced;
- ▼ The high voltage power supply has been repaired; or
- ▼ If the picture size or aspect ratio changes.

When the projector is set up for new sources, the Threshold Offset must be set to the default level of 80 prior to setting G_2.

Sensitivity/Threshold Offset

To set the Sensitivity/Threshold Offset for a new source:

1. Select a channel from the channel list.
2. Press CONV to access Convergence mode.
3. Press MODE and toggle to Sensitivity or Threshold.
4. Press MENU to display the SHADE AXIS MENU on the screen.
5. Select CLEAR SHADE AXES (clears Sensitivity to the default level of 128 and Threshold to the default level of 80).
6. From the SHADE AXIS MENU select INIT ALL PROPTN. This initializes all Proportions to 230.

G2 Setting

G2 sets the threshold of the CRT image and is adjusted along with Sensitivity Offset using the Pluge test pattern. These two settings determine the level of the darkest and brightest areas of the screen image. G2 is preset at the factory and may need little or no adjustment. Do these adjustments in sequence, one color at a time.

7. Adjust for full size image on the screen. (Refer to the sections on Position/Phase and Size).

8. Adjust Menu Position using the Grey Scale and the Timing Setup Menu. (Refer to the Menu Position section).

To set G2:

1. Cut off R and B and view G.
2. Select the Pluge test pattern.
3. Adjust green G2 so that the small, black rectangle in the center of the larger, black rectangle is just barely visible (Figure 3-8).
4. Select the Dot Pattern test pattern and toggle the HIDE key. While toggling, verify there is no change in the background raster brightness. (The Dot Pattern will turn on and off as the HIDE key is toggled but the background brightness should not change while toggling.) If the background brightness changes as the HIDE key is toggled, G2 is set too high and the procedure should be repeated. When readjusting G2, look for a slightly less visible small, black rectangle in the larger, black rectangle.
5. Select the Pluge test pattern again.
6. Cut off G and view R.

   NOTE: When setting the G2 levels for green, red, and blue, they should be set as closely as possible so that all 3 colors are at approximately the same level.

7. 7. Repeat steps 3 and 4 for the red G2 level.
8. 8. Cut off R and view B.
9. 9. Repeat Steps 3 and 4 for the blue G2 level.

   NOTE: G-2 adjustments affect Color Balance, Shading, and Proportional Offset. After completing the G-2 setting, verify and readjust these adjustments.

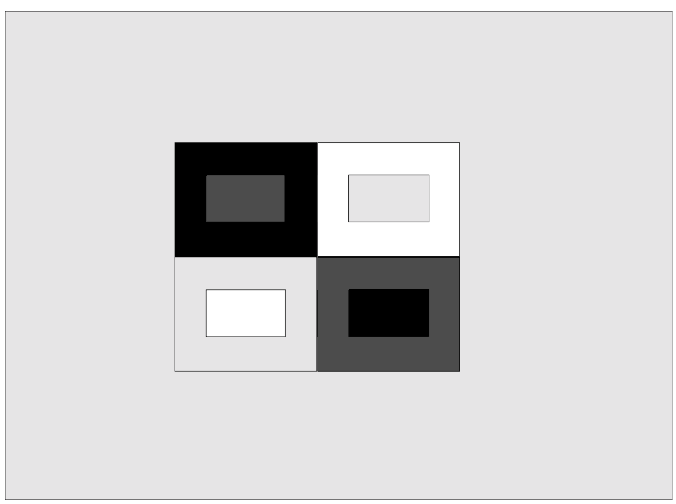


Figure 3-9 The Pluge test pattern. Use the two small rectangles in the center to set G2 and Sensitivity Offset.

3.11 Arc Lamp Alignment and Focus

The Arc Lamp must be realigned and refocused whenever the lamp is replaced or becomes defocused or misaligned from physical shock to the projector. Refocusing only may be required if the Arc Lamp has been in use for a long time. Adjustment procedures for Model 330 projectors differ from those for the Model 340SC and Model 370SC projectors and are each detailed in the following sections.

Model 330 Arc Lamp Alignment and Focus

To check Model 330 Arc Lamp alignment, confirm the "hot spot" (brightest area) of the screen is centered on a flat field test pattern.

If the hot spot is not centered, the Arc Lamp needs alignment.

To check if focusing is needed, use a flat field test pattern to measure the brightness at the center of the screen and at the corners with a light meter, using all four (4) corners to determine the roll-off. The roll-off (gradual decrease in brightness from center to corners) should be between 2:1 and 4:1. **Do not** try to compensate for a dim corner by adjusting the Arc Lamp—dimness in one or two corners is usually caused by variations in the **ILA®** assemblies and will be corrected by Shading adjustments. Perform the Arc Lamp focusing procedure **only if** the roll-off in all four (4) corners is too high.

CAUTION! In the interest of safety, please read these entire procedures, *prior to performing any adjustments*, in order to become familiar with the special **NOTES** and **CAUTIONS** indicated.

To align the Model 330 Arc Lamp (refer to Photo 3-2):

1. Use a long-handled Hexhead tool (a long handle helps keep fingers away from Ignitor terminals) to loosen the four (4) Arc Lamp holding screws very slightly, just so that the washers under the screwheads become loose enough to move on the shaft.

   CAUTION! Be careful to not touch the Arc Lamp—it is very hot! Be especially careful when loosening the bottom screw so that the shaft of the Hex tool does not touch the Ignitor terminals to the right of the tool.

2. Insert 2 Allen wrenches in the X and Y adjustment screws.
3. Turn the Allen wrenches in or out to center the hot spot on the screen.

4. When the hot spot is at the center of the screen, retighten the four (4) Arc Lamp holding screws.

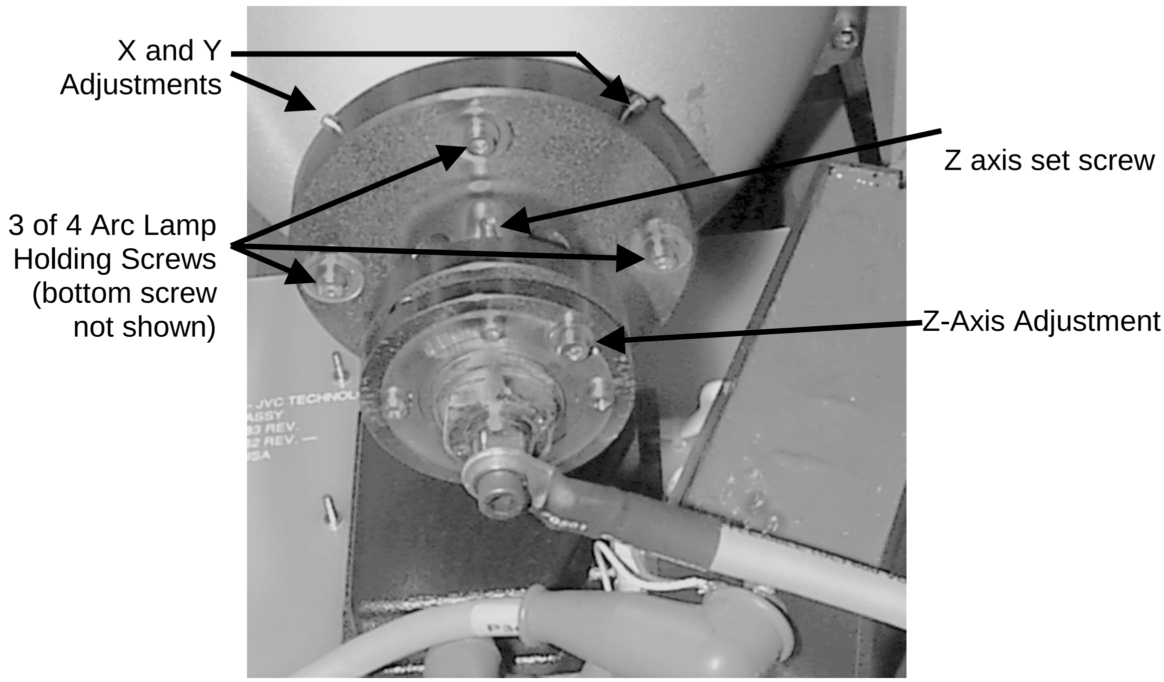


Figure 3-10 Model 330 Arc Lamp Adjustments (the Heat Sink has been removed for photograph).

To refocus the Model 330 Arc Lamp:

1. Loosen the Set Screw on the Arc Lamp shaft.
2. Adjust the Z-axis hexhead screw so that the screen is fairly even in brightness from center to the corners with the center being the brightest.
3. Use a light meter and adjust the Z-axis adjustment screw for a roll-off (drop in brightness from center to corners) of a maximum of 4:1 (preferably closer to 2:1).
   Example: If the center of the screen measures 20 foot-candles, the corners should measure 10 foot-candles ideally,
   but no less than 5 foot-candles.

   CAUTION! Do not leave the roll-off at a value higher than 4:1, or the center may be too bright and could result in damage to the cold mirror.

4. Retighten the set screw.

Model 340SC and 370SC Arc Lamp Alignment and Focus

To check Model 340SC and 370SC Arc Lamp alignment, observe the anode shadow on the blue dichroic mirror (the blue dichroic mirror is the first mirror after the condensing lens). Verify that the anode shadow (small, dark oval inside the light circle) is a uniform oval that is no more than ½ inch or no less than ¼ inch in diameter.

If the oval looks non-uniform or has a flare coming from one (1) side, adjust the X-Y plates in the following manner:

1. Use a standard Phillips screwdriver and loosen the two (2) top screws on the pivot holes (refer to Figure 3-9). Slide the plates on their pivots until the shadow looks uniform.
2. While viewing Test Pattern 6 (Static Flat Field) the uniformity on the screen should become more centered also.

To refocus the Model 340S and 370SC Arc Lamp:

1. Adjust the Z-axis of the Xenon Arc Lamp using a 9/64 inch hexhead balldriver and rotate the screwhead (see Figure 3-9) for overall brightness from the center to the edges with a minimum of roll-off (roll-off is the gradual difference in brightness from the center of the screen to the edges). Only a turn or two should be required.
2. Verify the proper brightness after the adjustments are complete with a light meter by measuring the foot-candles of light output at the screen center and multiplying this measurement by the area of the screen in square feet.

   Example: If the screen area is 15x20 = 300 sq. ft.
   and the light output on the light meter measures 20 foot-candles, the brightness level in lumens is 300x20 = 6000 lumens.

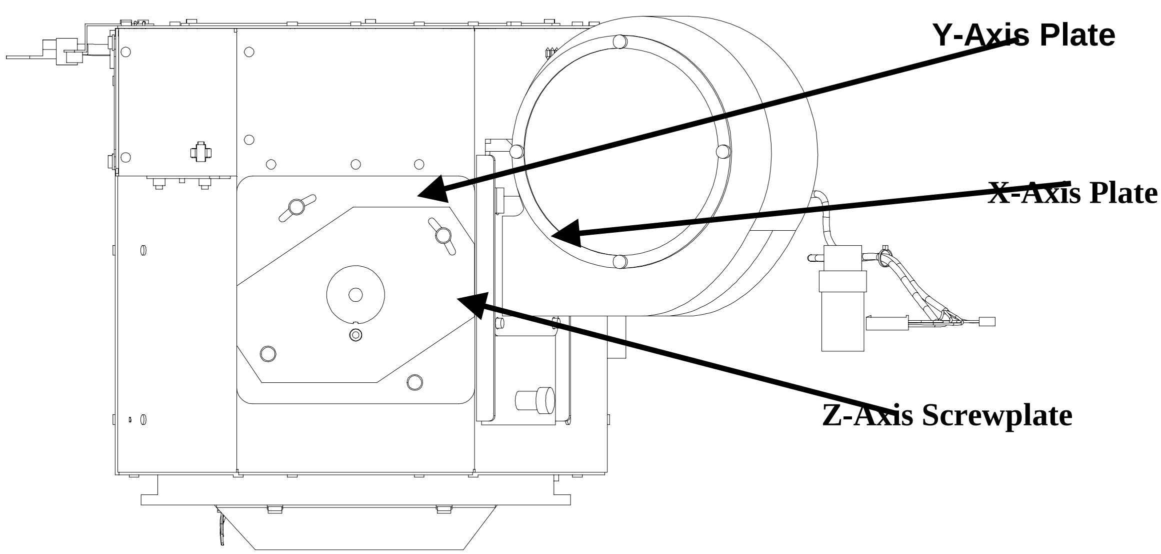


Figure 3-9. Model 340SC and 370SC Arc Lamp Adjustments

3. Verify that the condensing (collimating) lens assembly has not moved (see Figure 4-1 or 4-2 and Photo 4-4). Check to see if the assembly is loose. It should be unmovable in any direction.
4. The barrel of the lens assembly should be no more than 1½ inches (usually much closer) from the blue dichroic mirror. If it needs to be moved closer, first loosen the 3mm set screw located at the top of the mounting ring (Photo 4-4) that the barrel sets in, then move the lens closer to the blue dichroic mirror. This will increase the center brightness. Roll-off may not be acceptable if the barrel is moved too far forward.

   NOTE: Be careful to maintain proper roll-off in these illumination optics (arc lamp and condensing lens) adjustments. It is possible to get very high brightness values at the screen center at the expense of proper roll-off. Try to keep the ratio between center brightness and edge brightness. Roll-off is 2:1 to the edge and 4:1 to the corners (e.g.: if the center brightness is 20 foot-candles, the edge brightness should be at least 10 foot-candles and preferably 10 foot-candles).

   CAUTION! Do not leave the roll-off at a value higher than 4:1, or the center may be too bright and could result in damage to the cold mirror.

5. Retighten the set screw.

3.12 Arc Lamp Current Adjustment

The Arc Lamp current must be reset whenever an Arc Lamp is replaced and should be rechecked every 500 hours of Arc Lamp operation.

CAUTION! If the Arc Lamp current is being adjusted due to the installation of a new Arc Lamp or Arc Lamp/Ignitor assembly, the current adjust pot (Photo 4-3) must be turned to minimum (fully CCW). Failure to do this may result in damage to the equipment including failure of the Arc Lamp, Ignitor, or power supply.

To check and adjust the Arc Lamp current:

1. Measure the output voltage at the System Power Supply (SPS) Ignitor terminals J503 and J504. Note this figure.

2. Measure the number of millivolts between pins 3 and 4 on SPS J505.

   NOTE: This circuit is designed so that the number of millivolts between these pins (for Models 340 and 370, it is millivolts divided by 10) represents the lamp current in amps.

3. Multiply the two (2) figures from Item 1 and from Item 2 together.
4. Divide the product from Step 3 by 1 for Model 330 wattage. Divide the product from Step 3 by 10 to get wattage for Model 340SC or 370SC.
5. Adjust the Lamp Current Adjust pot (see **CAUTION** below Table 3-1**)** on the top of the SPS (refer to Figure 4-3) until this result is within the appropriate HJT model spec indicated in Table 3-1).

   Example (for Model 370SC): Voltage measured between J503 and J504 = 28V and voltage measured between pins 3 and 4 of J505 = 1070mv.
   The product of this is 29960÷10 = 2996W. This result is within the Model 370SC spec of 3000W ± 25W and would not require adjustment.

Table 3-2 Arc Lamp Current and Amp Specs

Model 330	Model 340SC	Model 370SC
1500 Watts ± 25W	2000 Watts ± 25W	3000 Watts ± 25W
68 Amps Normal	80 Amps Normal	100 Amps Normal
70 Amps Maximum	85 Amps Maximum	110 Amps Maximum

CAUTION! Make adjustments in small increments to ensure lamp integrity (lamp overheating may occur if current is abruptly increased). Do not increase the current beyond the maximum levels listed in Table 3-2.

4.0 Maintenance Remove/Replace)

Contents

4.1 Introduction

This chapter covers procedures on removal, replacement, and adjustment of a specific assembly or subassembly.

NOTE: Before performing the front or rear cover or replacing any components or subassemblies, please review the Safety Section at the front of this manual. These procedures must be performed by HJT certified maintenance engineers and technicians only.

When performing removal and replacement procedures, protect yourself and equipment by following these precautions:

- Turn projector power off with the remote.
- After the cooling fans have stopped running, turn the projector off at the circuit breaker and disconnect the power cord.

- Wait at least a minute after turning off power and removing the power plug for the high voltage to bleed off.
- Observe all cautions and warnings printed on labels.
- Observe proper electrostatic discharge procedures.

The major removal and replacement sections are as follows:

Projector Covers.
Ventilation Filters.
Ignitor Assembly.
Arc Lamp Assembly.
System Power Supply.
Electronics Module.
Cathode Ray Tube.
Video Amplifier Board.
CRT Yoke.
High Voltage Power Supply.
Card Cage PCBs.
Image Light Amplifier (**ILA**®) Assembly.
Projection Lens.

Procedures in this manual make reference to the left or right side of the projector. Left and right are determined while standing at the rear of the projector, facing the screen.

WARNING!!! Disconnect AC power from the projector before performing any removal and replacement procedures.

The following tools are needed to perform maintenance and service:

Standard computer service tool box.
Metric socket set.
Hex driver set.
Offset hex ratchet screwdriver.
Conductive electrostatic wrist strap with ground clamp.
Proper safety equipment and clothing.

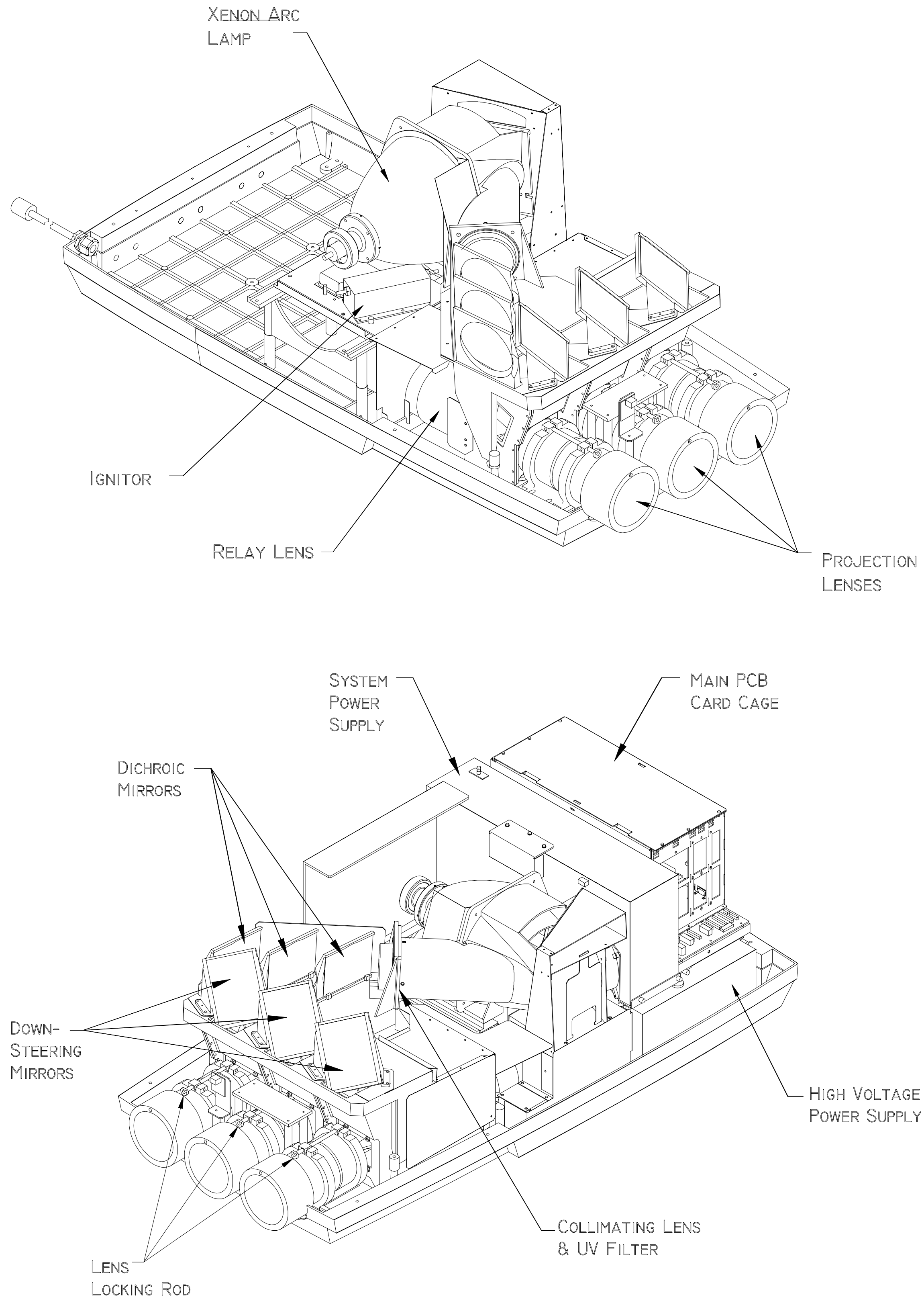


Figure 4-1 Major components of the Model 330 Projector.

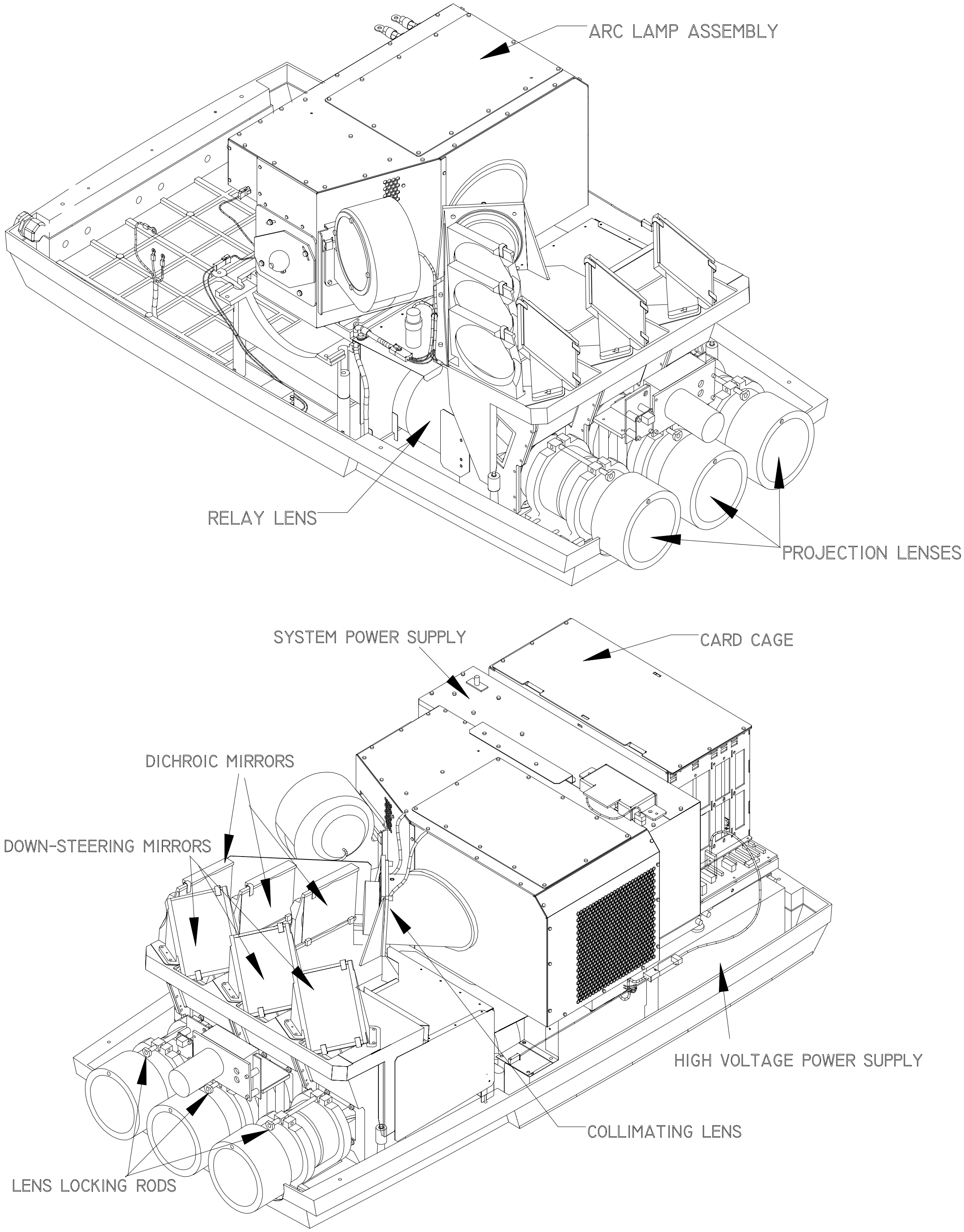


Figure 4-2 Major components of the Model 340SC and 370SC Projectors.

4.2 Projector Covers

To remove the two-piece projector cover:

CAUTION! When removing the projector covers do not bump any internal components of the projector. If any undue resistance is felt, pause to locate the source of resistance before proceeding with cover removal. If the projector has been operating, and the rear cover must be removed, be sure to set the power interlock switch to the UP position immediately and turn the projector back on with the remote, then turn the power back off with the remote. This allows power to be reapplied to the fans to cool the arc lamp which remains very hot even after power is removed. During a normal power shutdown the fans will continue to run for several minutes to cool the arc lamp.

1. Unplug the projector.
2. Remove the four (4) front cover and two (2) rear cover screws.

   NOTE: When both covers are to be removed, the front cover should be removed first. However, the rear cover may be removed by itself if necessary.
3. To remove the front cover, first pull cover forward about 10cm. Disconnect the fan connector on the left inside of the front cover.
4. Carefully slide the front cover forward and off the projector.
5. To remove the rear cover, from the rear of the projector, grasp the side ribs and lift the whole cover upward and toward the back.
6. To replace the covers, reverse the removal procedure.

4.3 Ventilation Filters

Filters should be cleaned every two (2) months or 500 hours of operation, whichever comes first. If excessively dusty or dirty conditions prevail, filters should be cleaned more frequently.

There are two (2) filters which need periodic cleaning and inspection.

Both are located on the right side of the front and rear covers.

To remove and clean ventilation filters:

1. Unplug the projector.
2. Remove the filter in the right, front cover by unsnapping the filter cover.
3. Wash with soap and water or blow clean with an compressed air.
4. For the filter in the right, rear cover, remove the rear cover. Pull the filter away from the velcro. Wash with soap and water or blow clean with compressed air.

NOTE: This filter can also be removed, while leaving the rear cover in place, by removing the two screws at the top of the side panel where the filter is located. Slide the panel up and out.

4.4 Arc Lamp Assembly

The Arc Lamp Assembly, which includes the Ignitor, is located in the middle section of the projector. Separate instructions for both the Model 330 and the Model 340SC and 370SC arc lamp assembly removal follow.

WARNING!!! High Voltage points of up to 40,000 volts are exposed inside the projector covers. It takes at least a minute to bleed off high voltage even after the unit has been turned off.

Model 330 Ignitor and Arc Lamp Assembly (P/N 900611S) Removal

To remove the Ignitor Assembly or Xenon Arc Lamp from
a Model 330 Projector:

Refer to Photo 4-1 for right and left orientation and to perform the following procedure. Label any connectors prior to removing to ensure they are reconnected correctly.

1. Unplug the projector.
2. Remove the front and rear projector covers (see Section 4.2).
3. Disconnect and label the four (4) high voltage cables that are connected to the Ignitor.

   NOTE: If the small, black wire on J503 (where the black negative cable connects from the Ignitor to the System Power Supply) is disconnected in order to remove the Ignitor negative cable, be sure to reconnect it when reinstalling the Ignitor. This wire carries the boost voltage that keys the Ignitor on.

   CAUTION! Do not disconnect the cable from the arc lamp end! If returning the arc lamp, leave both cables attached to avoid misaligning the Arc Lamp interior components.

4. Remove the three (3) ground straps from the Ignitor and Arc Lamp. Leave them connected to the projector.

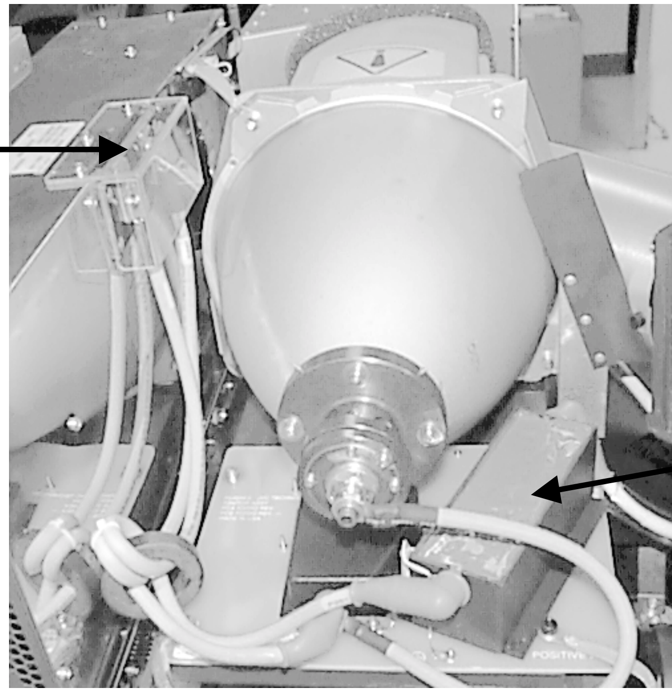


Figure 4-3 Model 330 Arc Lamp and Ignitor Assembly (P/N 900611S), shown without Heat Sink attached)

5. Remove the three (3) Hex-head screws that attach the Ignitor Assembly to the Arc Lamp rails.
6. Put on protective clothing, including safety goggles and face shield.
7. Slide the Arc Lamp and Ignitor Assembly out, being careful to clear the plastic cover on the top of the System Power Supply (where two (2) of the Arc Lamp cables are attached).
8. Place the Arc Lamp and Ignitor Assembly on a safe, level surface and turn it over on its' side.
9. Remove the two (2) bottom screws that attach the Ignitor Assembly to the Arc Lamp rails.
10. The units are now separated for returning.
11. Perform the above steps in the reverse order to replace the Arc Lamp or Ignitor Assembly. When reattaching the cables, be careful to reconnect them to their correct terminals in accordance with the way they were labeled in Step 3 above. Be sure that the connections are tightened securely. Use Table 4-1 below as a guide when reconnecting the cables.
12. Perform the Arc Lamp Focus and Alignment procedure (Section 3.11) and the Arc Lamp Current Adjustment procedure (Section 3.12).

NOTE: Whenever an Arc Lamp is replaced the Collimating Lens (Figure 4-3) may need to be readjusted to obtain maximum brightness. Follow the procedure in Section 4.4.3 to readjust the Collimating Lens.

Table 4-1 Ignitor Connections for Model 330 Projector

Ignitor Terminal	Location on Ignitor	Wire Color	Wire goes to:
POS INPUT	Right Side of Ignition Coil	Red	J504 (+) terminal on System Power Supply.
NEG INPUT	Negative Terminal Lug mounted on circuit board	Black (on J503 side)	J503 (-) terminal on System Power Supply.
NEG INPUT	Negative Terminal Lug mounted on circuit board	Black	Terminal on rear of Arc Lamp.
POS OUTPUT	Left Side of Ignition Coil	White	Enters middle of Arc Lamp Housing.

Model 340SC and 370SC Ignitor Assy/Arc Lamp Assy (P/N 104651 or 104120) Removal

To remove the Ignitor Assembly or Xenon Arc Lamp from a Model 340SC and a Model 370SC Projector:

Refer to Figure 4-4 and Figure 4-5 throughout the procedure below and to establish right and left orientation. Label any connectors prior to removing to ensure they are reconnected correctly.

1. Turn power off at the remote and circuit breaker and unplug the projector. Do not attempt to remove or replace the Arc Lamp assembly without first ensuring that power is off and the projector is unplugged from the AC wall outlet.
2. Remove the front and rear projector covers (Section 4.2).
3. Put on protective clothing, including safety goggles and face shield.
4. Disconnect the black and red Arc Lamp high voltage cables from System Power Supply J503 and J504 and untie the J505 cable that is wrapped around J503. Do not unplug this cable from J505—it is wrapped around J503 to keep it in place in case it must be removed in order to replace the System Power Supply.
5. Disconnect the fan connector at the left front of the Arc Lamp housing.
6. Disconnect the cable from the Squirrel Cage blower on the right side of the Arc Lamp housing.
7. Remove the Start Capacitor from the bracket adjacent to the Arc Lamp assembly (one nut underneath the capacitor).
8. Cut the cable tie wrap (not shown in Figure 4-4 or Figure 4-5) at the bottom rear of the Arc Lamp assembly (beneath the fan on the bottom rear of the Arc Lamp assembly).
9.

10. Remove the two (2) ground straps (not shown in Photo 4-2 or Photo 4-3) from the top, right side of the Arc Lamp assembly housing. Leave these straps attached to the Collimating Lens housing.
11. Remove the two (2) hex bolts on the left and right side of the Arc Lamp assembly that attach the Arc Lamp assembly to the mounting rails (lower front of the Arc Lamp assembly). When removing the hex bolts, also remove the ground straps and leave them attached to the Relay Lens bracket.

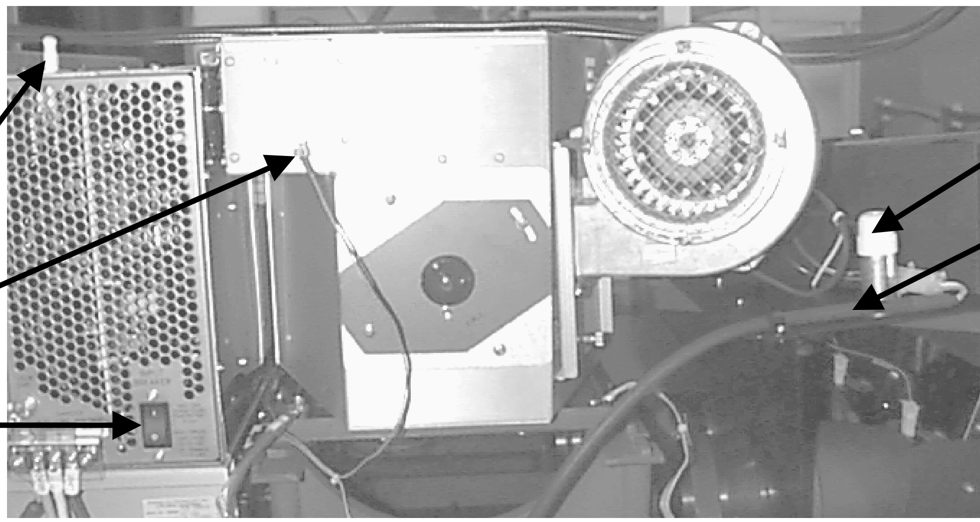


Figure 4-4 Model 340SC and 370SC Arc Lamp Assembly

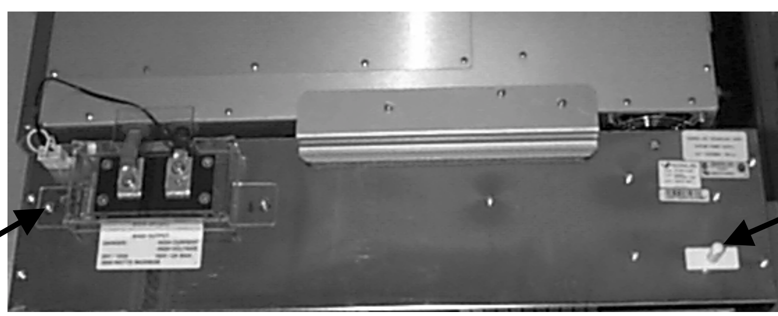


Figure 4-5 System Power Supply-Arc Lamp Connection.

12. Carefully slide the Arc Lamp assembly out from the right side of the projector.
13. Perform the previous steps in the reverse order to replace the Arc Lamp Assembly. When reattaching the cables, be careful to reconnect them to

their correct terminals in accordance with the way they were labeled above. Be sure that the connections are tightened securely.

NOTE: Whenever an Arc Lamp is replaced the Collimating Lens may need to
be readjusted to obtain maximum brightness. Follow the Collimating Lens Adjustment procedure in Section 4.4.3 to accomplish this.

NOTE: The Arc Lamp current must also be reset when an Arc Lamp is replaced. The procedure for adjusting the Arc Lamp current and verifying power output is in Section 3.12 (Model 340SC is 2000W ±25W and Model 370SC is 3000W ±25W).

CAUTION! Make adjustments in very small increments to insure lamp integrity (lamp overheating may occur if current is abruptly increased). Do not increase the current beyond the amount specified in Table 3-1, Section 3.12 or damage to the equipment could occur.

Collimating (Condensing) Lens Adjustment

To adjust the Collimating Lens (refer to Photo 4-4):

1. Loosen the 3mm set screw located at the top of the Colliminating Lens housing (that the Collimating Lens barrel fits into).

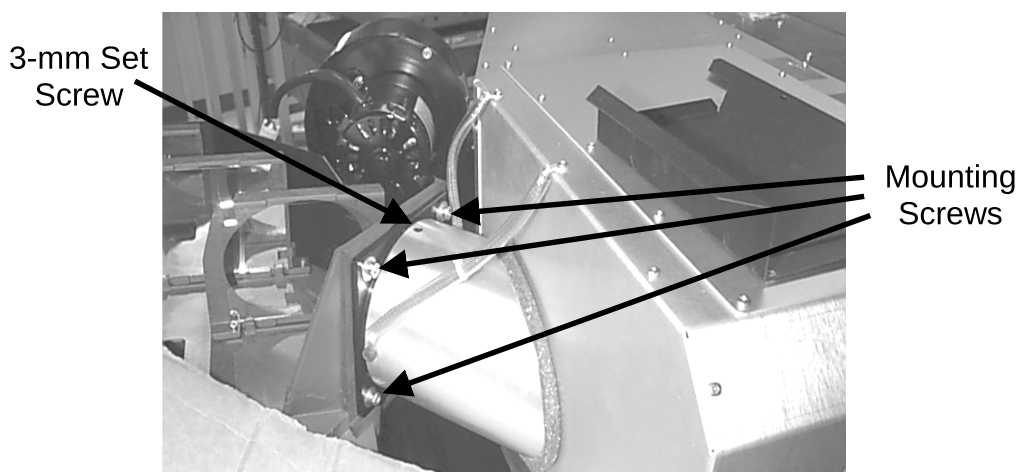


Figure 4-6 Collimating Lens Adjustment (shown on Model 370SC)

2. Move the Collimating Lens closer to the Blue Dichroic mirror. This increases center brightness. Roll-off may not be acceptable if the barrel is moved too far forward. Roll-off is the gradual difference in brightness on the screen from the center to the edges. Try to keep the roll-off between center and edge brightness to 2:1.

Example: If the center brightness is 20 foot-candles, the ideal edge brightness should be 10 foot-candles.

CAUTION! Do not allow roll-off to be greater than 4:1 or damage to the Cold Mirror could result. Refer to Section 3.11 information on how to check roll-off.

3. In some cases it may also be necessary to adjust the vertical and horizontal orientation of the collimating lens to achieve maximum brightness.

CAUTION! This adjustment can be sensitive and should not be attempted unless all other measures have been tried first. To do this, loosen the three (3) mounting screws on the rear of the condenser lens mount (*see Figure 4-6*) and move the collimating lens to orient the hot-spot (brightest area) to the center of the screen.

4.5 System Power Supply

The System Power Supply is located immediately forward of the electronics card cage.

To remove the system power supply (*see Figure 4-4 and Figure 4-5 and Figure 4-7*):

1. Unplug the projector. Allow at least one (1) minute for high voltage to bleed off before proceeding.
2. Remove the rear projector cover (*Section 4.2*).
3. Remove the two (2) screws from the Plexiglas cover over the terminal block (*top of SPS, forward-Figure 4-1*) and remove cover.
4. Label and remove the arc lamp ignitor cables, J503 and J504, and the shield ground wire from the DC terminal block.
5. Remove the Plexiglas cover from the AC input terminal block located on the right side of the power supply (*see Figure 4-7*).
6. Ensure power is disconnected then remove the three (3) AC input wires from the AC terminal block:

   Green (or Yellow/Green) left terminal (Ground).

   White (or Blue) middle terminal (Neutral).

   Black (or Brown) right terminal (Hot).

NOTE: Colors may be different, depending on country of use.

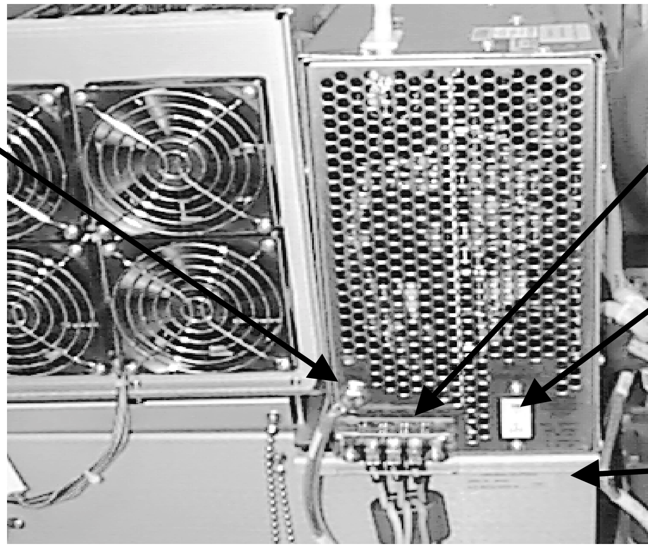


Figure 4-7 System Power Supply (right side of projector)

7. Remove the grounding cable from the right side of the power supply (*see Figure 4-7*).
8. Loosen and release the two (2) captive screws at the base of the power supply, located on the right side below the AC terminal block (*under the mounting bracket–Figure 4-7*).
9. Move to the left side of the power supply and cut the tie wrap securing the HVPS anode leads to the power supply (*see Figure 4-8*).
10. Remove the screw securing the wire bundle clamp to the power supply (Figure 4-3).
11. Unplug the three (3) system power supply connectors (Figure 4-3).
    Do not pull on the connector wires-unplug from power supply by squeezing the latching tabs and pulling on the connector shell or housing.
12. Loosen and release the two (2) captive screws at the base of the power supply (Figure 4-3). Ensure the nylon spacers on the captive screws do not get lost.
    Be sure to replace them between the power supply and the support lip when reinstalling the power supply.
13. Lift the power supply off from the projector.
14. Perform the above steps in the reverse order to replace the System Power Supply. Be sure that all connectors are firmly seated and locked and all pins are mating. When reinstalling the Arc Lamp cables to the DC terminal block (*Step 4 above*), a torque wrench should be used. The Arc Lamp connections to the top of the SPS should be torqued to 25-30 in. lbs.

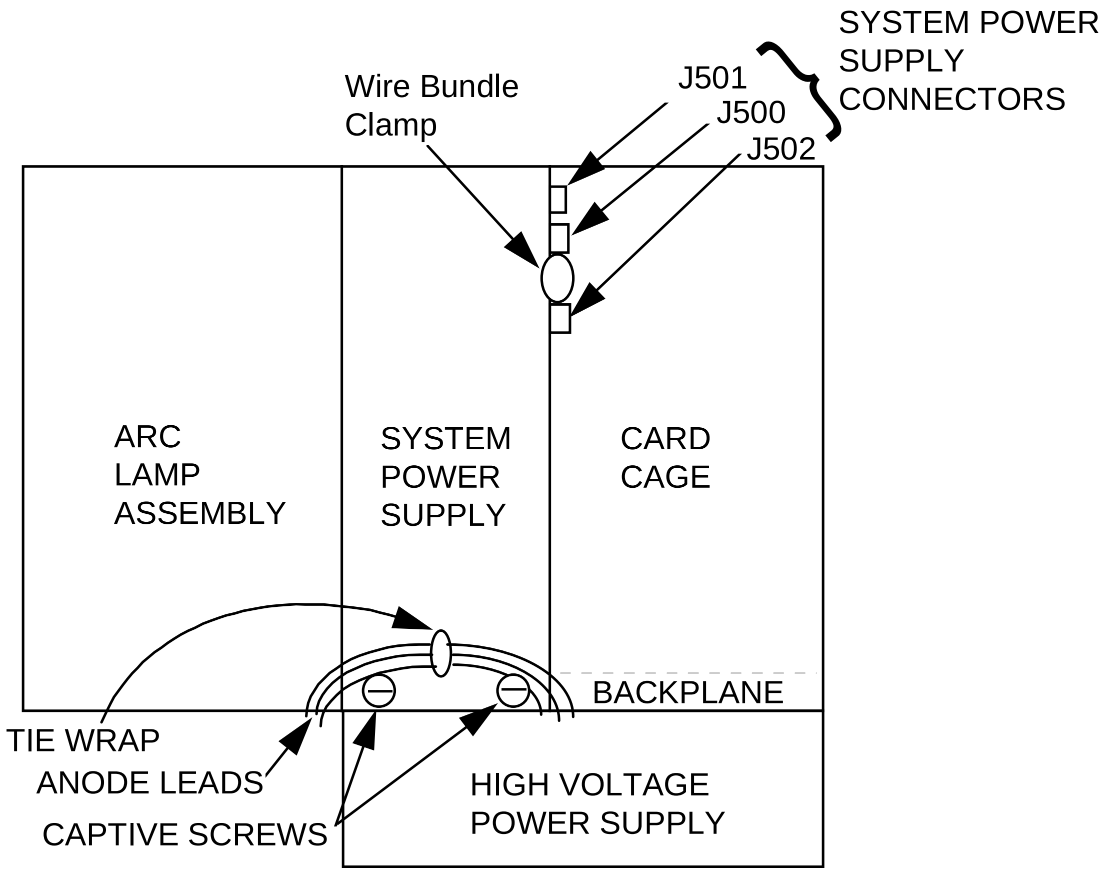


Figure 4-8 System and HV Power Supply (left side of projector)

4.6 Electronics Module

The Electronics Module is the entire assembly to the rear of the Arc Lamp and optics assemblies. The Electronics Module consists of the system power supply, card cage, and CRT housing assembly.

To remove the Electronics Module:

1. Unplug the projector. Allow at least one (1) minute for high voltage to bleed off before proceeding.
2. Disconnect the system power supply.
   - 2.a If the system power supply is to be removed from the Electronics Module, remove the system power supply following instructions in Section 4.5.
   - 2.b If the system power supply is not to be removed from the Electronics Module, disconnect the system power supply following instructions in Section 4.5, Steps 1 through 7.
3. Free the power cord from the electronics module by removing the cable clamp(s) on the right side base of the electronics module.

4. At the rear of the projector, remove the three (3) filter housing screws (located under the rear lip of the projector base-plate) and remove the filter housing.
5. On the left side of the projector, unplug connectors P82 and P83 from the backplane and move the wiring harness out of the way.
6. Back all CRTs into the CRT assembly (focus rod screws, at the rear of the CRT assembly, to the stops—refer to Photo 4-6.
7. At the base of the electronics module remove the hex screw at each corner (four [4] screws).
8. Ensure that all control and input cables are disconnected from the back of the card cage then tilt the card cage back.
9. Remove the two (2) hex screws in the base of the electronics module under the card cage. Tilt the card cage back forward.

CAUTION! Remove anything plugged into the rear electronics jacks or the plugs could be severely damaged when the module is tilted back.

10. Remove the electronics module (two people) by grasping the handles at the rear and the lip under the system power supply in the front.

CAUTION! Do not bump the CRT cooling bellows while removing the electronics module! The CRT cooling bellows (refer to Figure 4-4) are fragile and easily damaged. If damaged, the CRT must be replaced and will not be covered by warranty. Use extreme care removing and replacing the electronics module and CRTs.

11. Replace the module in the reverse order.
12. After the module is replaced, perform a CRT mechanical focus adjustment (refer to Section 3.7).

4.7 Cathode Ray Tube (CRT)

Three (3) cathode ray tubes are located in the CRT assembly below the card cage and system power supply. The following procedure is used to remove any CRT:

WARNING!!! Handle a CRT with extreme caution. If dropped they can implode and flying glass can cause severe injury to personnel. Never bump or drop the tube. Use extreme care when removing and replacing CRTs. Dispose of the tube immediately.

Model 330 CRT Removal

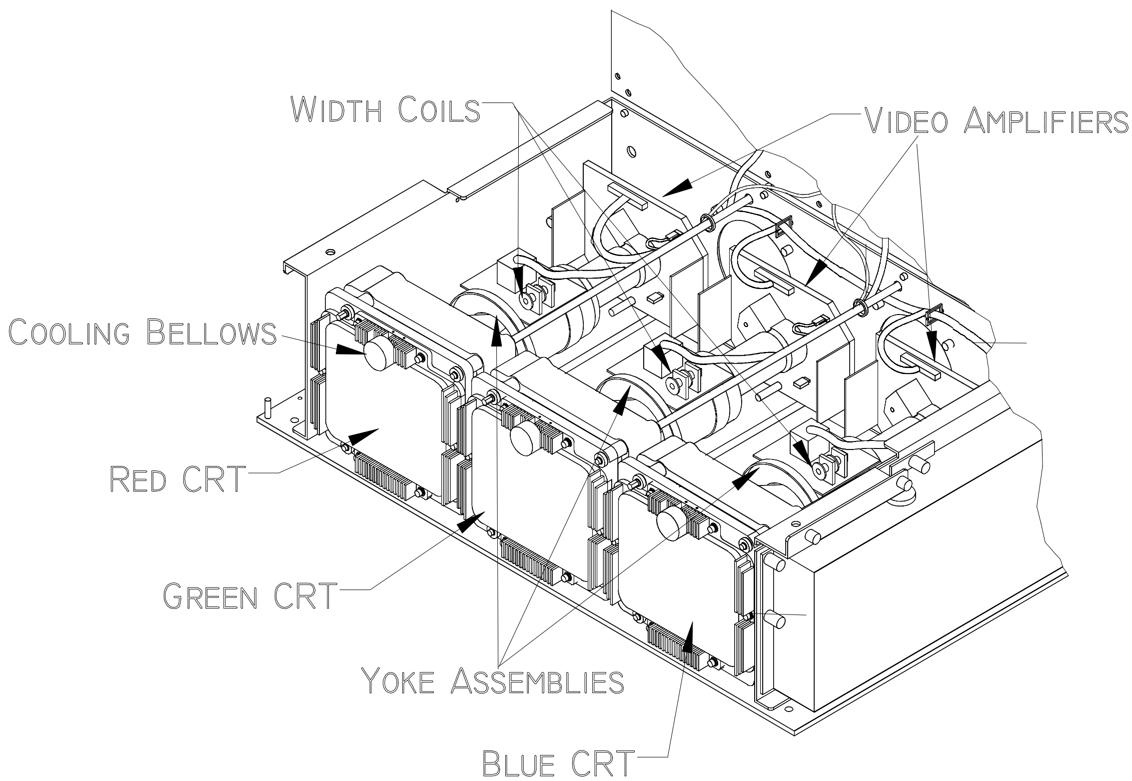


Figure 4-9 Model 330 CRT Assembly

To remove a Model 330 CRT Assembly (refer to Figure 4-4):

1. Unplug the projector. Wait at least a minute before proceeding for the high voltage to bleed off.
2. Remove the electronics module (Section 4.6).

   NOTE: Removal and replacement of a CRT may be more easily accomplished with the System Power Supply removed from the electronics module. This is not absolutely necessary and it is up to the technician's discretion whether or not to remove it (Section 4.5).

3. After removing the System Power Supply, remove the system power supply mounting plate that covers the top front area of the CRT Assembly.
4. Run the CRT all the way forward using the Z axis focus rod at the rear of the CRT assembly (Photo 4-6).
5. Remove the video amplifier board from the CRT Assembly (Section 4.8).
6. Inside the CRT housing, remove the cable clamp(s) from the CRT anode cable.
7. Inside the CRT housing on the left side, disconnect the CRT anode cable from the bulkhead connector. Ensure the entire anode cable is free.
8. Loosen the yoke clamp and ensure the yoke is loose on the CRT neck.
9. Remove six (6) mounting screws at the face of the CRT.
10. Gently remove the CRT by sliding it forward out of the yoke and CRT housing.
11. Replace the CRT in the reverse order.
12. Perform a CRT mechanical focus adjustment, yoke alignment, horizontal width adjustment, vertical size adjustment, and linearity adjustment after replacing the CRT (refer to the appropriate model Operator's Manual).

Notes on replacing a Model 330 CRT:

Orient the bellows on the front of the CRT to the top side.

Remove the plastic coating from the tube screen only after the CRT has been installed.

Tighten all CRT mounting screws in a diagonal pattern.

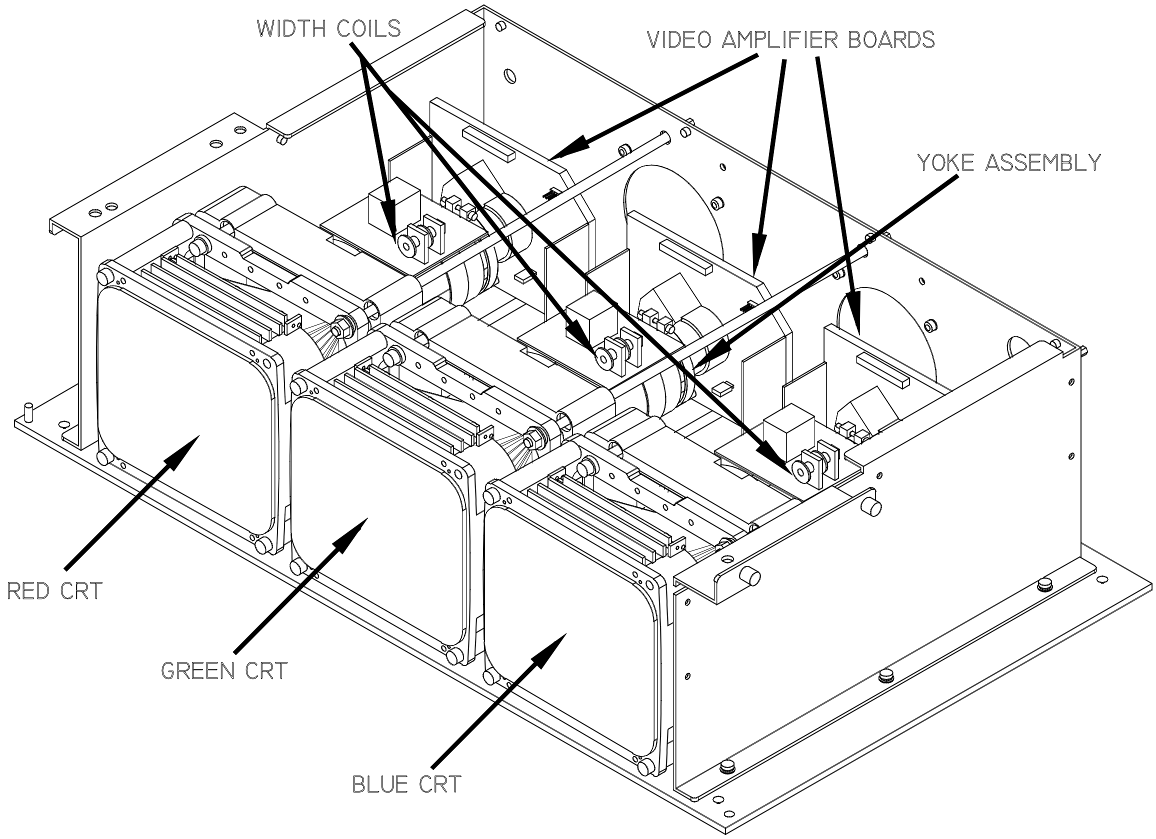


Figure 4-10 Model 340SC and 370SC CRT Assembly

Figure 4-11 CRT Z-Axis Focus Adjustment Rods (circled).

Model 340SC and 370SC CRT Removal

To remove a Model 340SC and 370SC CRT (*see Figure 4-10*):

1. Unplug the projector. Wait at least one (1) minute before proceeding for the high voltage to bleed off.
2. Remove the electronics module (Section 4.6).

   NOTE: Removal and replacement of a CRT may be more easily accomplished with the System Power Supply removed from the electronics module. This is not absolutely necessary. It is at the technician's discretion to remove it or not (refer to Section 4.5).
3. After removing the System Power Supply, remove the System Power Supply mounting plate that covers the top front area of the CRT Assembly.
4. Run the CRT all the way forward using the Z axis focus rods at the rear of the CRT assembly. This allows more room to remove the CRT socket.
5. Remove the video amplifier board from the CRT Assembly (refer to Section 4.8).
6. Inside the CRT housing, remove the cable clamp(s) from the CRT anode cable.
7. Inside the CRT housing on the left side, disconnect the CRT anode cable from the bulkhead connector. Ensure the entire anode cable is free. Loosen the yoke clamp and ensure the yoke is loose on the CRT neck.
8. Remove three (3) mounting screws at the face of the CRT. Gently remove the CRT by sliding it forward out of the yoke and CRT housing.
9. Replace the CRT in the reverse order.
10. Perform a CRT Mechanical Focus adjustment and yoke alignment after replacing the CRT (refer to Section 3.7 and 3.2).

Notes on replacing a Model 340SC and 370SC CRT:

Orient the CRT high voltage cable connector downward.

Remove the plastic coating from the tube screen only after the CRT has been installed.

4.8 Video Amplifier Board (VAB)

The video amplifier boards are located inside the CRT housing. They are mounted on and fully supported by the CRT neck. There is one (1) video amplifier board on each CRT.

To remove a VAB (*see Figure 4-9 or Figure 4-10*):

1. Unplug the projector. Wait at least a minute before proceeding for the high voltage to bleed off.
2. Remove the rear projector cover (Section 4.2).

3. Ensure that all control cables are disconnected from the back of the cardcage then tilt the card cage back to expose the inside of the CRT housing.
4. Unplug and label the five cables connected to the VAB.
5. Unplug and remove the VAB from the back of the CRT.

   CAUTION! The connector pins on the CRTs are easily damaged. If damaged, the CRT must be replaced and will not be covered by warranty. Use extreme care when taking the VAB out of the CRT housing to avoid damage to the CRT connector pins. In some cases, it may be necessary to move the CRT all the way forward (Z axis focus rod, rear of CRT assembly—see to Figure 4-11).

6. Perform the above steps in the reverse order to replace the VAB.
7. Perform a CRT Mechanical Focus adjustment (Section 3.7) after replacing the VAB.

4.9 CRT Yoke

The CRT yoke is located on the CRT neck and is supported by the CRT. There is one (1) yoke for each CRT.

To remove the CRT yoke (*see Figure 4-9 or Figure 4-10*):

1. Unplug the projector. Wait at least one (1) minute before proceeding for the high voltage to bleed off.
2. Run the CRT all the way forward (Z axis focus rod, rear of CRT assembly).
3. Remove the video amplifier board (see Section 4.8).
4. Loosen the yoke clamp and ensure the yoke is loose on the CRT neck.
5. Disconnect the yoke cable connector. Slide the yoke assembly off the rear of the CRT.

   CAUTION! The connector pins on the CRTs are easily damaged. If damaged, the CRT must be replaced and will not be covered by warranty. Use extreme care when taking the yoke out of the CRT housing to avoid damage to the CRT connector pins. In some cases it may be necessary to use the two other mechanical focus adjustment rods to tilt the CRT to allow the yoke to be removed from the CRT neck.

6. Perform the above steps in the reverse order to replace the yoke assembly.

7. Perform a CRT mechanical focus adjustment (Section 3.7) and yoke alignment (Section 3.2) after yoke replacement.

4.10 High Voltage Power Supply (HVPS)

The HVPS is located on the left side of the projector next to the CRT housing assembly.

To remove the HVPS:

1. Unplug the projector. Wait at least a minute before proceeding for the high voltage to bleed off.
2. Run all three (3) CRTs all the way forward using the Z axis focus rods at the rear of the CRT assembly (Photo 4-6).
3. Remove all three (3) video amplifier boards (refer to Section 4.8 and either Figure 4-4 or Figure 4-5).
4. Remove the System Power Supply (see Section 4.5).
5. Remove the System Power Supply mounting plate (covers High Voltage Power Supply).
6. Inside the CRT housing on the left side, disconnect all three (3) CRT anode cables from the bulkhead connectors. As an added precaution, short the anode leads to the High Voltage Chassis ground to bleed off any residual charges. Slide the anode wire connectors off their mounting brackets.
7. In the bottom rear of the CRT housing, cut the tie wraps holding the HV, G2, and focus cables.
8. Carefully slide all G2, and focus cables out of the CRT housing.
9. Remove the top connector (power control) at the rear of the HVPS.
10. Loosen and release the five (5) captive screws at the base of the HVPS:

    Two (2) screws are located forward.

    One (1) screw on top.

    Two (2) screws at the rear.

11. Remove the HVPS.
12. Replace the HVPS in the reverse order.
13. Perform a CRT mechanical focus adjustment, yoke alignment, G2 adjustment, and electronic focus adjustment after HVPS replacement (Sections 3.7, 3.2, 3.10, and 3.8).

    NOTE: When replacing the HVPS, ensure that the wires are routed to the proper color and that the wires are neatly placed in the bottom of the CRT housing.

4.11 Card Cage (Printed Circuit Boards)

The card cage is located at the rear of the projector above the CRT housing.

CAUTION! Printed circuit boards in the electronics module are susceptible to electrostatic damage. While servicing the projector be sure to observe electrostatic discharge precautions. Always wear a conductive wrist strap and ground lead when handling PCBs.

To remove a PCB:

1. Turn the projector power off at the remote. Wait at least one (1) minute for the high voltage to bleed off.
2. Remove the rear projector cover (*see Section 4.2*) and toggle the Main Circuit Breaker to off (*see Figure 4-7*).
3. Remove the eight (8) screws securing the electronics module cover and remove the cover.
4. Slide the card lock latches toward the center of the card lock and remove the card lock.
5. Lift the tabs of the card extractors on the edges of the PCB to unseat a card from its connector(s).
6. Lift the PCB from the electronics module.
7. Replace the PCB in the reverse order.

   NOTE: Each PCB has a dedicated card slot with keyed connector positions. Observe the connector positions prior to inserting to ensure proper placement.

   CAUTION! Before inserting a PCB into the card cage, ensure there are no bent pins on any connectors. The PCBs may need to be slightly flexed or jostled in order to properly seat them into the backplane. Be sure that all connectors on a PCB are properly aligned with and started into their mating connectors on the backplane before applying pressure on the PCB or its card extractor tabs to seat it.

   NOTE: When replacing the horizontal deflection board, the Horizontal Deflection Board (P/Ns 100566 & 102523) could be damaged if the board is not seated properly on the Backplane. This problem usually occurs when the HDB is removed and reinserted after a board failure or when changing the sweep reversal connector. A failure can occur if connector J11 on the HDB (located at the far right when viewing from the component side) does not connect completely with P11 on the backplane.

To ensure a proper connection between J11 and P11 follow the procedure below:

Before installing the Horizontal Deflection Board, remove the Vertical Deflection Board. This allows for a full inspection of the proper connection of J11 and P11. The P11 connector on the backplane is slightly loose to allow movement for minor dimensional differences in the position of the J11 connector on the HDB. Do not tighten connector P11 on the backplane.

4.12 Image Light Amplifier Assembly

The ILA® Assemblies are located in the optics module near the front of the projector, directly ahead of the relay lenses.

To remove an ILA® Assembly:

1. Remove the front projector cover (Section 4.2).

   NOTE: It may be necessary to remove the left side air baffle cover in order to gain access to the Blue and Green **ILA®** Assemblies. To remove the cover, remove the three (3) securing screws and pull the cover loose from the velcro tabs.

2. Remove the bias connector from atop the ILA® assembly to be removed. Mark all bias connectors, or remove one (1) ILA® assembly at a time to avoid misconnections.
3. Loosen the hold down clamps on either side of the ILA® assembly (loosen about 1 turn).
4. Lift the ILA® assembly out of its mount. Use care to avoid getting finger prints or other contamination on any optical surfaces.
5. Perform the above steps in the reverse order to replace the ILA® assembly.

CAUTION! The **ILA®** assemblies should be clamped only enough to eliminate play in the mount. Overtightening can cause unpredictable performance while undertightening may result in improper focus and color reproduction.

4.13 Projection Lens

Projection lenses are located at the front of the projector and are held in place by friction clamps called Lens Locking Rods.

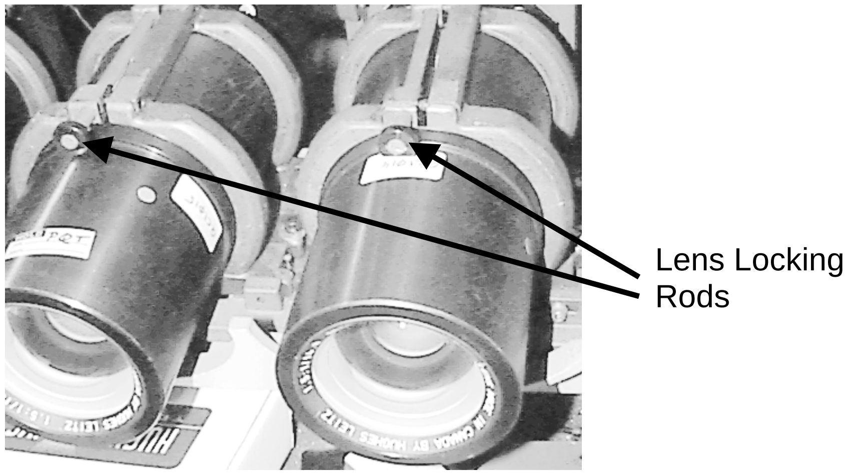


Figure 4-12 Projection Lens Locking Rods

To remove a projection lens (*see Figure 4-12*):

1. Turn off the projector.
2. Using a slot screwdriver, loosen the lens locking rod and turn the clamp at the top of the lens (first, see **WARNING** below) until the flat part of the clamp is facing down.

   WARNING!!! Be very careful when performing this procedure, especially if the projector is tilted downward, because the lens can fall out and seriously injure personnel.

3. Carefully pull the lens out of the clamp housing.
4. Perform the above steps in reverse order to replace the projection lens.

   NOTE: Projection lenses are color sensitive. When replacing lenses ensure they are placed in the correct positions. Use

Table 4-2 for reference to part numbers, if necessary.

Table 4-2 Lens Replacement

Lens Throw Ratio	Lens Part Number or Designation		
	Red	**Green**	**Blue**
1.5:1	101241	101241	101715
3:1	900609-3	900609-2	900609-1
5:1	101239	101239	101239
7:1	101240	101240	101240

NOTE: More details on lens options, converters and other lens information can be found in the appropriate model *Operator's Manual*.

4.14 (SCB) Socket Battery Replacement

As indicated in the troubleshooting table (under "Picture-Various Problems", weak backup RAM socket batteries in the SCB can cause lost data when the projector is turned off and back on again. All four (4) of these batteries should be replaced at the same time if this condition occurs.

CAUTION! Never place the socket battery on a metal surface! The positive and negative terminals could short out and destroy the battery!

WARNING!!! Danger of explosion if this battery is incorrectly replaced! When replacing the Lithium batteries, be sure they are ilnstalled with the correct polarity. If installed backwards they could explode! Replace only with the same or equivalent type recommended by the manufacturer. Dispose of the old Lithium batteries in accordance with local safety codes. Contact your local authorities for proper disposal procedure.

To replace the SCB socket batteries:

CAUTION! When replacing SRAM all channel data will be lost. All channel data must be downloaded.

1. Download all channel data on the System Controller.
2. Remove the System Controller Board PCB (refer to Section 4.11).

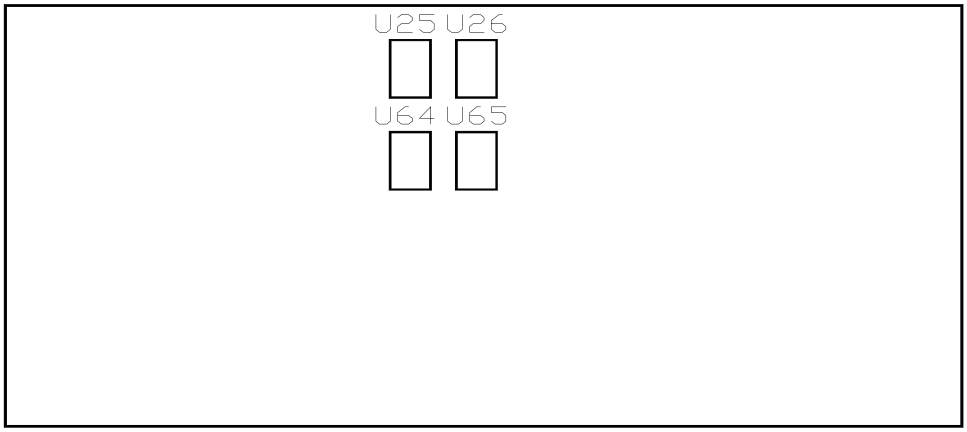


Figure 4-13 System Controller Board SRAM Chips Location.

CAUTION! Never place the socket battery on a metal surface! The positive and negative terminals of the battery will short out and destroy the battery!

3. The four (4) socket batteries are located in the chip inserts beneath the SRAM chips, U25, U26, U64, and U65 (refer to Figure 4-6 for location). Remove the four (4) SRAM chips and batteries from the SCB (note the position of pin 1 by the key in the chip-pin 1 is at the upper left looking down at the chip with the cutout key at the top).
4. Carefully separate the socket batteries from the socket extensions (*see Figure 4-14*). DO NOT remove the SRAM chip from the extension.
5. Reinsert the SRAM chip and extension into the new socket batteries.

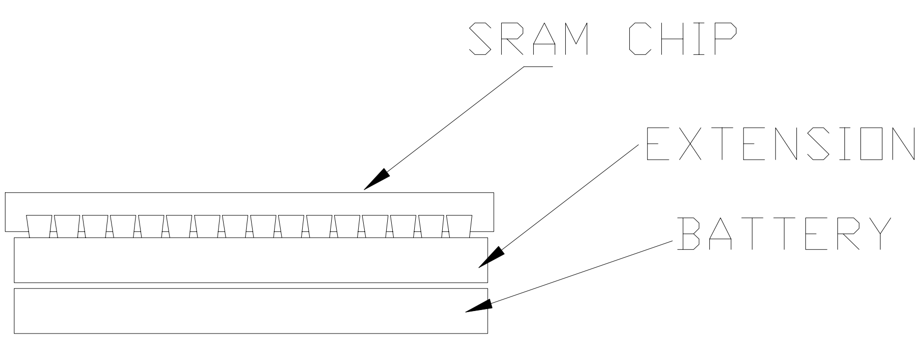


Figure 4-14 SRAM Chip, Extension and Battery Side View

6. Carefully reinsert the socket batteries and SRAM chips back into the SCB.
7. Reinstall the SCB.

4.15 Recommended Spares

It may be advisable to maintain a supply of spares to maximize performance. This is particularly important if projectors are being operated on a continuous basis or when multiple projectors are used. Table 4-3 provides a list of recommended spares for one (1) to four (4) Series 300 model projectors.

Table 4-3 Recommended Minimum Spares

Description	Quantity	330	340SC	370SC
			PART NUMBERS	
System Power Supply	1	104070	104071	104038
Arc Lamp Assembly	1-4	900611S	104651	104120
Ignitor	1	102083	102207	104475
High Voltage Power Supply	1	100562	100562	103769
Raster Timing Generator	1	100568	100568	100568
Horizontal Deflection Board	1	102523	102523	102523
Vertical Deflection Board	1	102521	102521	102521
Video Processing Board	1	104672	104672	104672
Video Amplifier Board	1	103567	103567	103567
System Controller	1	104668	104668	104668

5.0 Troubleshooting

Contents

5.1 General Information

This chapter provides information and solutions on probable projector problems, including Error Codes, Power-On Codes, and Break Points for HJT Model 330, Model 340SC and Model 370SC Projectors with software version 5.1.0.

The Error Codes listed in Table 5-1 describe possible problems associated with software and hardware while the projector is operating. The first (1st) column of the table lists the LED letters shown on the rear of the projector, and the second (2nd) column for the first seven (7) letters shows the on-screen text that shows along with the operator messages (up to 19 characters). The remaining codes appear without on-screen text—the second (2nd) column is the error description. Status or error codes are flashed for no more than one (1) minute before being replaced with the neutral beating “0” (zero) at a low light level.

The Power Codes in Table 5-2 show the sequence of codes that occur when the projector power is first turned on. The first (1st) column indicates the LED code letter or number and the second (2nd) column provides a description of the problem.

Break Point (Trap Processing) Error Codes and Break (Trap) Data Code Displays are detailed in Table 5-3 and Table 5-4.

The Menu Structure Diagram provides information about the Projector Menu Log that will help to determine if certain assemblies are due for replacement.

Table 5-5 provides a Troubleshooting Guide to possible problems encountered in the Model 330, 340SC and 370SC Projector. The first (1st) column calls out the nature of the problem and a possible symptom to check. The second (2nd) column suggests possible solutions. The third (3rd) column provides the reference section in this manual. The fourth (4th column supplies the reference section in the appropriate model Operator's Manual.

Table 5-1 Error Codes for the Model 330, 340SC and 370SC Projectors

LED	On-Screen Text	Description
Codes shown along with operator messages.		
b	A RAM BATTERY IS LOW	Memory problem—data may be lost if power-off.
c	COLOR IS CUTOFF	Adjustment being attempted on cut-off gun.
d	DSP INIT FAILURE	Convergence logic is dead at power-on.
l	LAMP TO-ON, BUT OFF	Arc lamp did not light.
m	LAMP TO -OFF, BUT ON	Problem detecting arc lamp state.
p	POWER TO-ON, BUT OFF	Power supply problem.
w	POWER TO-OFF, BUT ON	Power supply problem.

LED	Description
Codes indicating temporary error state or hardware problem.	
a	An internal table controlling timing is momentarily full.
e	A CPU trap error has occurred. This is potentially serious.
f	The internal system command queue is momentarily full.
g	Problem with the terminal-in port timing.
h	Problem with the terminal-in port operation.
i	Problem with the DSP output circuits—convergence may be lost.
j	DSP time-out—should recover automatically. May affect convergence.
k	Problem with the IIC hardware—Type 1.
o	Problem with the IIC hardware—Type 2.
q	Hardware detected source change but nothing found by software.
r	Problem with DAC hardware.
s	Vertical sync not detected.
t	Loss of video-OK detected.
u	Problem with Extron communication.
v	Extron communication time-out.

LED	On-Screen Text	Description
x	Problem with decoder module data.	
y	Problem with decode input.	
#	Loss of horizontal sweep detected.	

Codes indicating a software bug—system should keep running.	
G	Internal error code not recognized.
H	Incoming command not recognized.
J	Internal password control code bad.
K	DAC reference not recognized.
L	Timer table reference not valid.
M	IIC reference not recognized.
N	RTG reference not recognized.
P	Internal convergence axis reference invalid.
Q	Internal channel parameter reference not recognized.
R	Internal convergence data index invalid.

5.2 Power-On Codes

The projector performs a series of operations when power is turned on. Codes for these operations are shown on a LED display at the rear of the projector. Operations are divided into two (2) sets:

1. The first (1^{st}) set occurs when standby power is applied. For example, the projector is plugged into a proper outlet and the circuit breaker on the side of the projector is ON.
2. The second (2^{nd}) set takes place when the user issues a “power-on” command. For example, presses “Control-P” on a VT-100 terminal or “POWER ON” on the I/R or tethered remote.

First Set

The first (1st) set of operations occurs when the +5volts is activated to the SCB prior to applying power to the projector (standby mode). After the +5volts is applied, the LED should display a zero or #—if not displayed, there is a problem with the SCB.

Verify the following conditions:

1. Verify that +5volts and +24volts standby LEDs are lit. If STB +5volts and +24volts are not present, verify that the projector is plugged into a proper outlet and that the circuit breaker on the right side of the projector is on. If

STB +5volts or +24volts are still not present after verifying that the circuit breaker is on and the projector is plugged in, the System Power Supply may be defective.

NOTE: Only the +5 volts LED is lit on the Backplane Status Indicator panel (see Figure 2-2) when A/C power is applied. When the projector is directed to Power-On the +24volts standby LED should light and fans should be running.

2. If STB +5volts and +24volts are present, the SCB is the most likely cause of the problem.

Second Set

The second (2nd) set of operations only complete if no errors occur. If an error is detected, the code corresponding to the failed operation is displayed, and remains on the LED until the circuit breaker is cycled or another user "Power-On" command is issued. These errors are far more likely to occur than those of the first set.

Table 5-2 Codes for Second Set of Operations (User "Power-On")

Code	Description
F	"Lamp On" not detected.
E	SCB defective.
B	Low Voltage Power Supply output not detected.
9	SCB defective.
8	SCB defective.
7	SCB or RTG defective.
6	SCB defective.
5	SCB defective.
4	Any PCB in the Card Cage could be defective.
3	SCB defective.
2	SCB defective.
1	SCB defective.
0	All systems okay; start-up is finished. LED stays at 0 unless the SCB receives an error signal that is listed in Table 5.1.

5.3 Break Points

Break Points (or Trap Processing) handle internal interrupts generated by the processor, such as: bus errors, illegal instruction, and divide by zero commands.

Perform the following steps to setup for break codes (trap processing):

1. Access MAIN MENU and select #4 (DIAGNOSTICS MENU).
2. Select #7—this is an invisible menu item.
3. Press ENTER to clear the displayed break (trap) data.

When a break (trap) occurs, the CPU stops normal operation and outputs a code to the LED located at the rear of the projector. The code consists of the character “*e*” followed by a “*2*” through “*C*.” The error code displays in a continuous loop. Error codes and explanations are provided in Table 5-3.

Table 5-3 Break Point (Trap Processing) Error Codes

Code	Meaning	Description
2	Bus error.	Probably electrical noise.
3	Address error.	Noise or program bug.
4	Illegal instruction.	Noise or program bug.
5	Zero divide.	Program bug.
6	CHK instruction.	Unlikely—may be a bug.
7	TRAPV instruction.	Unlikely—may be a bug.
8	Privilege violation.	Bug.
9	Trace.	Noise.
A	Line 1010 emulator.	Noise.
B	Line 1111 emulator.	Noise.
C	Spurious interrupt.	Hardware.

Resetting the Projector

The projector's processor must be reset if a break (trap) condition occurs. The processor can be reset by either of the following methods:

1. Cycle main power off, then back on (allow ten minutes for Arc Lamp to cool).
2. Press the reset button (labeled S1) located at the top center of the SCB.

Break (Trap) Data from the Diagnostics Menu

After resetting the projector, retrieve the break (trap) data from the diagnostics menu by performing these steps:

1. Access MAIN MENU and select #4 (DIAGNOSTICS MENU).
2. Select #7—this is an invisible menu item.
3. Press ENTER to clear the displayed break (trap) data.

Break (trap) data is displayed in the format as indicated in Table 5-4.

Table 5-4 Break (Trap) Data Code Displays

Code	Description
EXCPT N	Description per list in the LED display errors above.
PC	Program counter value-program location when trap occurred.
SR	Status register value.
IR	Instruction register value.
AA	Access address.
FLAGS	R/W, I/N and FC flags and values.

Use a *Service Report* to write down all the break (trap) data. The service report will be analyzed by a Hughes-JVC technician to determine the problem.

5.4 Main Menu Structure

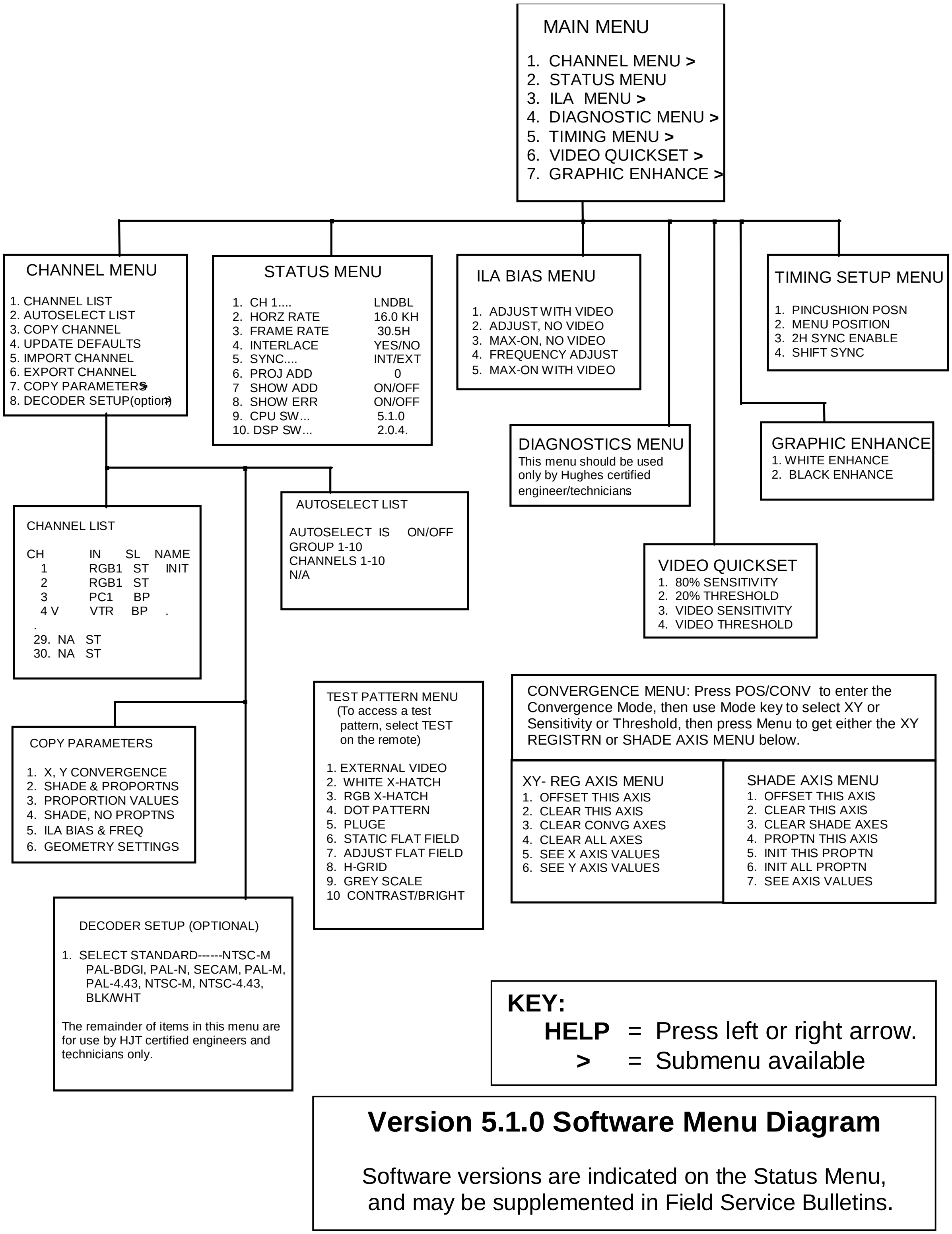


Figure 5-1 Menu Structure Diagram.

Table 5-5 Troubleshooting Guide

Problem and Symptom to Check	Possible Solution	Service Manual	Operator Manual
No Power			
Main input power.	Reset circuit breaker.	3-1	
System Power Supply main circuit breaker.	Reset System Power Supply circuit breaker. Reset interlock switch to the UP position.	3.1, Figure 3-1	
System Power Supply circuit breaker fails when reset?	Verify input power is correct. Replace defective System Power Supply	4.5	
Power Interlock Switch.	Test switch operation. If defective, replace switch.	Figure 3-1	
Projector cover not enabling interlock switch.	Reposition rear cover.	4.2	
System Power Supply shuts down during power up sequence.	Re-seat circuit boards.	4.11	
No Picture			
Correct channel selected.	Select correct channel input.		4.2
Arc Lamp turned off.	Restart projector.	3.1	4.1
System power turned off.	Restart projector.	3.1	
Video source.	Verify video source is turned on, properly connected.		
"HIDE" command invoked.	Un-hide video using **HIDE/MODE**.		Table 5-1
Color Cutoff.	Turn on R,G, B. Press R, G, B and CUTOFF.		
No video or raster on only one CRT.	Replace defective CRT or Video Amplifier Board.	4.8, 4.9	
Raster present but no video image.	Replace Video Amplifier Board or Video Processor Board.	4.11	

Problem and Symptom to Check	Possible Solution	Service Manual	Operator Manual
LEDs 200, 300, or 400 on the vertical deflection are unlit.	Replace Vertical Deflection Board.	4.11	
LEDs 200 and 201, or 300 and 301, or 400 and 401 on the vertical deflection are unlit.	Replace Horizontal Deflection Board if any two (2) are unlit.	4.11	
Increasing G2 voltages decreases brightness level for all CRTs.	Faulty High Voltage Power Supply under full load. Replace High Voltage power Supply.	4.10	

Arc Lamp			
Arc lamp will not light-'clicking' sound audible when projector is commanded ON.	Replace worn out Arc Lamp.	4.4	
'Clicking' sound not audible when projector is commanded ON.	System Power Supply or Ignitor Assembly faulty. Replace SPS or Ignitor Assembly.	4.5	
Arc Lamp ignites but will not stay lit.	Replace defective Ignitor Assembly.	4.4	
Brightness flicker or Picture very dim.	Arc Lamp may have too many hours. Replace Arc Lamp.	4.4	

Problem and Symptom to Check	Possible Solution	Service Manual	Operator Manual
Image out of focus			
Spacer balls not visible.	Set projection lens focus so **ILA®** spacer balls are visible.		4.5
ILA® Spacer balls visible but image fuzzy.	Adjust CRT Mechanical Focus.	3.7	4.7.2
CRT focus range is limited and image is fuzzy.	Adjust electronic focus.	3.8	4.7.3
CRT focus not effective.	Set Relay Lens against back stop.		
CRT focus not effective.	Ensure **ILA®** assembly is installed correctly and clamps are snug.	4.12	
CRT focus limited due to focus rod range.	Readjust fixed rod at upper left of CRT mounting bracket.	3.7	
Image blurry with shadow on right edge.	Replace **ILA®** Assembly.	4.12	
Characters do not appear legible.	Replace **ILA®** Assembly.	4.12	
CRT focus problem limited to single color.	Replace CRT.	4.7	
G2 mis-adjusted.	Reset G2.	3.10	
Sensitivity offset set too high.	Reset sensitivity offset.		
Picture geometry			
Picture not centered.	Adjust using **PHASE** and **POSITION**.		4.8
Picture size incorrect.	Adjust using **SIZE** and **BLANKING**.		
Picture wrap around left or right edge.	Reset left or right **BLANKING**.		
Retrace lines on raster.	Reset **TOP BLANKING**.		

Problem and Symptom to Check	**Possible Solution**	**Service Manual**	**Operator Manual**
Video has shadow on left or right edge.	Correct using **MENU POSITION** and **PINCUSHION POSITION**.		
Video image not squared.	Correct using **PINCUSHION POSITION** and **KEYSTONE.**		
Video image bowed at left/right edge or top/bottom.	Correct using **PINCUSHION** left/right arrow.		
Picture horizontal linearity.	Correct using **LINEARITY** and **EDGE LINEARITY**.		

XY Convergence			
Linearity different between colors, cannot converge.	Yoke not properly set on CRT.	3.2	
Horizontal size different between colors.	Adjust horizontal sizing coil on yoke.	3.5	
Vertical size different between colors.	Set vertical size and linearity adjustment on Vertical Deflection Board.	3.3, 3.4	
Not enough range in Red/Blue XY convergence.	Adjust Red or Blue **POSITION** to compensate.		4.8.9

Picture color balance			
Missing either Red, Green, or Blue video.	ILA® assembly bias voltage bad or no video-replace Video Processor Board.	4.11	
Red, Green, or Blue lacks color.	Replace ILA® assembly or Video Amplifier Board.	4.12, 4.8	
Internal gray scale correct but incorrect video color.	Readjust **CONTRAST** adjustments.		
Dim area on screen when viewing flat field.	Adjust collimating lens.	4.4	
Black video image overdriven.	Adjust **THRESHOLD**, **G2** and **BRIGHTNESS**.	3.10	4.6, 4.10

Problem and Symptom to Check	Possible Solution	Service Manual	Operator Manual
Bright Red, Green or Blue area on screen limited to corners or edge.	Adjust ILA® Assembly Bias and **SHADING**.	3.6	4.10
Gray scale green in bright levels.	Subtract Green **SENSITIVITY** offset, add Red and Blue.		4.10, 4.11
Gray scale red in bright levels.	Subtract Red **SENSITIVITY** offset, add Green and Blue.		
Gray scale blue in bright levels.	Subtract Blue **SENSITIVITY** offset, add Green and Red.		

Picture—various problems			
Out of focus blurry area on image limited to R, G, or B.	Clean oily spot off CRT, Prism, or Projection lens.		
Small dark line or dot in R, G, or B image.	Scratch in optics or CRT burn.		
Bubbles in R, G, or B image.	Replace affected ILA® assembly.	4.12	
Image Ghost on video.	Replace Burn-In CRT or ILA® assembly.	4.7, 4.12	
Reversed ghost image on screen.	If projecting through glass, prevent light from reflecting back into the lens		
Picture lacks depth of field.	Adjust **Contrast** and **Brightness.**		4.12.1, 4.12.2
Video jitter and noise.	Replace Video Processor Board.	4.11	
Video jitter present at only one source.	Replace Raster Timing Generator.	4.11	
Video image is not level.	Level projector or rotate CRT Yoke.	3.2	
Black band at top of video.	Remove air bubbles from Prism.		

Problem and Symptom to Check	Possible Solution	Service Manual	Operator Manual
Data lost when projector is turned off and back on.	SCB socket batteries weak. "RAM BATTERY LOW" may appear on screen.	4.14	
"Flagwaving" at top of picture or top of image is skewed.	VCR mode (if using CVID or SVID input). Select 2H Sync Enable or Shift Sync Enable from the Menu.	5.3	Table 5-4
Convergence and/or shading is incorrect after doing copy channel.	Menu Position adjustment for the "Copied to" channel.		
Red bands across image after channel change.	Channel data not loading properly. Upgrade software.		
Communication error.	Unplug tethered remote at the projector and reconnect.		
Check hardwired cable for broken wires and/or if wired for RS-232 null modem.	Bad RS-232 null modem cable.		
Bad RS-232 interface port on the System Controller. Board.	Replace System Controller Board.	4.11	
LCD displays erroneous characters.	Unplug tethered remote at projector and reconnect.		

Infrared I/R Remote			
No response.	Set I/R remote dip switch settings.		5.8

Problem and Symptom to Check	Possible Solution	Service Manual	Operator Manual
Intermittent operation.	Replace I/R remote battery or move closer to projector. If not possible to move closer to projector, use an I/R repeater for distances of 50’ or more. Stay in “line of sight”.		
Sticking keys on the remote control.	Return remote control for replacement.		

Glossary of Terms

Adjust Flat Fld	Flat field test pattern used for shading purposes, (adjusts in 7º increments).
Amorphous	Without definite form; not crystallized.
Arc Lamp	The xenon arc lamp in the Series 300 series projectors. Produces dangerously intensive light with hazardous levels of ultraviolet and infrared radiation. It operates at high temperatures (180ºC, maximum 300º C, or over 500º F).
Aspect Ratio	The ratio of the picture width to picture height. The standard U.S. television aspect ratio is four units wide to three units high (1:1.33). High Definition Television (HDTV) is 16:9.
Bandwidth	The transmission or reception capacity of a computer or communications channel measured in bits per second in digital and in Hertz in communications. Bandwidth is the difference between the lowest and highest frequencies transmitted or received. Wider bandwidth provides more information or picture detail capability.
Blanking	Image adjustment used to mask out unwanted anomalies on the picture edges. Blanking can be adjusted inward from 0% on the left edge and top, and from 100% on the right edge and bottom.
Brightness	Overall or average intensity of illumination of a video display, setting black at 0%. Used with Contrast adjustment for best picture display.
Contrast/Bright	Test pattern used as reference for brightness and contrast settings.
Channel List	Displays status of all active channels.
Copy Channel	Projector function used to copy geometric and image adjustment data from one channel to any or all of the other 29 input channels
Chrominance	Abbreviated as "*C*." Color information signal or signals.

Cold Mirror	Mirror that absorbs infrared light so that its reflection contains only "cold' light that does not transmit appreciable heat. As a result of this absorption of infrared heat radiation, "cold" mirrors get quite hot.
Composite Video	Means of transmission sending the complete video signal consisting of chrominance, luminance and the sync signals. It is the NTSC standard.
Contrast	The ratio between the dark and light areas of a television picture, setting white at 100%. Used with Brightness adjustment for best picture display.
Convergence	The process of controlling CRT beam deflection to keep the R, G and B beams properly aligned when scanning the raster. Misconvergence shows up as color fringing on picture edges. Convergence adjustment compensates for the physical separation of the R, G and B tubes by aligning their output at a fixed distance from the projector. Convergence adjustments include X,Y-Axis Convergence and Black and White Uniformity.
CRT (Cathode Ray Tube)	The vacuum tube used as a display screen in video terminals or television sets. Commonly called the picture tube.
Export Channel	Exports setup data from projector to computer. Useful when servicing. See *Import Channel Data* and refer to Appendix 1 for more details.
Field	One half of a complete video frame. Odd lines in one field and even lines in another make up one frame.
Frame	One complete TV picture or screen of information. It is composed of two fields and has a total of 525 scanning lines in NTSC transmission.
Ganged	When R and B are ganged to Green, green is set first, then R and B are set to match G. Thereafter, if R or B are visible on screen, any adjustments to G will affect all three colors.
Graphics Adapter	A circuit card in a computer that has the function of converting signals used in a computer into signals that a monitor can use to display a video picture.

Gray Scale	Test pattern of black-to-white gradation bars. The more levels of gray scale that can be handled, the more realistic an image can be displayed, especially a photograph that has been scanned into the computer.
HDTV	(High Definition Television) Has approximately twice the horizontal and vertical emitted resolution of standard NTSC. HDTV systems are wide aspect ratio systems.
Hertz (Hz)	The standard unit of frequency. One Hz is equal to one cycle per second. A Kilohertz (KHz) is 1,000 cycles per second and a Megahertz (MHz) is equal to 1,000,000 cycles per second.
H-Grid	Test Pattern 8 with rows of white H's on screen, used as a focusing aid.
Horizontal Scan Frequency (H-Freq)	The rate at which horizontal lines are made to scan on a CRT. This is controlled by horizontal sync from the signal source.
Horizontal Scan Reversal Jumper	Reverses the image projection for front or rear projection. Located on the Horizontal Deflection Board.
Hue	Also referred to as tint. A specific color such a blue, pink or aqua. Hue or tint control on a display device adjusts red/green balance.
IDTV	(Improved Definition Television) Improvements that modify NTSC standards. Improvements may be at the source or the receiver.
Image Light Amplifier ILA®	A device that uses low-intensity images to phase-modulate a high-intensity light through a liquid crystal layer. It is the key component in producing very bright, high resolution images from **Hughes-JVC** large-screen projectors.
Import Channel	Imports setup data from computer to projector. Store setup data in computer and import during setup. Useful when servicing the projector. See *Export Channel Data* and refer to Appendix 1 for more details.
Infrared Repeater	Used with rear projection setups. Conveys infrared signals to HJT Series 300 Projector, since I/R remote control signals cannot reach I/R windows on the projector.

Intensity	Concentration of information or what would be seen if a black and white version of the image is displayed.
Interlacing	The technique that refreshes a display screen by alternately displaying all the odd lines (field one) and then all the even lines (field two) of one frame.
I/R Executive Remote	Used to control the Series 300 Projector during presentations. Limited use compared to the technician remotes; cannot permanently change any projector setup values.
I/R Technician Remote	Remote control used during Series 300 setup and adjustment. Alternative to optional terminal and tethered technician remote.
I/R Windows	The Series 300 Projector has two I/R windows, one in front, one in back. These windows receive projector control signals from the I/R remotes.
ISO 9001	Standard of Quality. Hughes-JVC received ISO certification May 15, 1997.
Keystone Adjustment	Corrects lines nearest to the screen edge to make them straight and parallel to the center line of the test pattern or square to the screen edge. The keystone adjustment is performed on green only and affects all RGB.
Keystone Image	Distortion resulting from having the projector improperly placed vertically with respect to the screen.
Lamp Assembly	Behind the optics assembly, the arc lamp and one "cold" mirror are mounted in an extension chamber.
Line Crawl	Tendency of the eyes to follow the sequentially flashing scanned lines of interlaced scanning up or down the screen in the same way that the eyes follow the sequentially flashing light bulbs on a movie theatre marquee. Line crawl tends to reduce vertical resolution.
Linearity Adjustment	Corrects for improper horizontal grid spacing on an image. With distorted linearity, lines in the grid are spaced closer together on one side of the image and farther apart on the other. The linearity adjustment is performed on green only and affects all RGB..

Lumen A unit of measure of the flow, or rate of emission, of light. An ordinary wax candle generates 13 lumens while a 100 watt bulb generates 1,200 lumens.

Luminance Abbreviated as "Y." The portion of the signal that contains the black and white information, which affects brightness.

Monochrome Single color and refers to monitors that display only one color along with back, such as white on black, black on white, green on black and amber on black.

MTS (Multi-Channel Television Sound) A stereo TV signal is transmitted together with the regular TV signal. Allows stereo audio for TV.

Multisync Monitor A display monitor that adjusts automatically to the synchronization frequency of the video display board that's sending signals to it. Multisync monitors can adjust to a range of frequencies, but not all of them.

Noise An undesirable electrical interference of a signal.

NTSC (National Television Standards Committee) The NTSC governs the standard for television and video playback and recording in the United States. The NTSC standard is 525 lines of resolution and is transmitted at 60 half frames (interlaced) per second.

Optics Module Contains the optics used to transmit light from the arc lamp to the projection channels (blue, green and red).

Overscanning Displaying less than the complete area of an image to a viewer (i.e., scanning beyond the visible area). All TV sets are overscanned at least slightly, so that viewers do not see blanking.

PAL (Phase Alternate Line) The 625-line, 50-field system used in the UK, Western Europe, Scandinavia, Australia, South Africa and other countries.

Pluge Test pattern used to set B/W scale. Grid of four squares within four squares.

Phase adjustment Positions the input image (test pattern, video, graphics, etc.) on the CRT raster. If the phase is misadjusted, the image may "wrap around" the edges or be positioned off the screen.

Pincushion Adjustment Corrects for warped distortion at the sides or top and bottom of the image. The pincushion adjustment is performed on green only and affects all RGB.

Raster The area illuminated by the scan lines on a CRT.

Resolution The degree of sharpness of a displayed or printed character or image; the amount of detail in a picture. On a display screen, resolution is expressed as the number of horizontal dots (columns) by the number of vertical lines (rows). For example, a 680 x 400 resolution means 680 dots across each of 400 lines.

Retrace The blanked-out line traced by the scanning beam of a picture tube as it travels from the end of any horizontal line to the beginning of either the next horizontal line or field. The beam is turned "off" during retrace.

RGB (Red, Green, Blue) Refers to the method of recording and generating colors in a video system. On a television or color monitor, colors are displayed as varying intensities of red, green and blue dots. When red, green and blue are all turned on high, white is produced. When all dots are turned off, the base color of the screen appears.

RGB X-Hatch Test pattern of aligned, alternating dots of RGB, used for convergence adjustment.

S-VHS A high band video recording process for VHS that increases picture quality and resolution capability. S-VHS tape machines use a special output terminal which allows separate output of luminance (Y) and chrominance (C) picture information to monitors equipped with S-Video inputs.

S-Video A video signal that has the luminance (Y) information separated from chrominance (C) information.

SAP (Second Audio Program) The MTS system for television also provides the ability to send an additional audio signal, called Second Audio Program (SAP).

Saturated Color 1) A color as far from white, black or gray as it can be (i.e., vermilion rather than pink).

	2) A display misadjustment that results in unnaturally bright colors.
Scan	To scan is to move across a picture frame a line at a time, either to detect the image, as in an analog or digital camera, or to refresh a CRT-based video screen.
Scan Line	One of many horizontal lines in a graphics frame.
Scan Rate	The frequency of line scanning for a monitor or projector.
SECAM	"Sequential couleur a memoire" (sequential color with memory). The French color TV system also used within the Soviet Union. It is not compatible with NTSC or PAL.
Sharpness	Apparent image resolution. High sharpness may be the result of high resolution, or it might be an optical illusion caused by image enhancement or by visible edges in a display, such as the vertical stripes of an aperture grille CRT.
Static Flat Fld	Test pattern, 100% white flat field.
Synchronization	Also called "sync" for short. Working together. At the same time, horizontal and vertical sync signals from the signal source control the monitor's scan circuits to properly time the lines and frames of a picture.
Technician Remote (Tethered)	Identical to the I/R technician remote, with the addition of a 20-character, 4 line display. Use the tethered remote exactly as you would the I/R technician remote to control the Series 300 during setup.
Throw	Distance to the screen from the projector.
Underscan	Decrease raster size H and V so that all four edges of the picture are visible on the display.
Uniformity (Black)	Adjustment for increasing brightness on the dark areas of the screen. Used with White Balance adjustment to obtain optimal projected image.
Uniformity (White)	Adjustment for decreasing brightness on the bright areas of the screen. Used with Black Balance adjustment to obtain optimal projected image.
Update Defaults	Updates picture setting default data. Technician-defined picture values as default values. User can change values

	temporarily with the Executive I/R remote.
Vertical Resolution	The amount of detail that can be perceived in the vertical direction; the maximum number of alternating white and black horizontal lines that can be counted from the top of the picture to the bottom.
Vertical Scan Frequency (V-Freq)	The vertical scan frequency of the input signal.
Vertical Synchronization Frequency	The number of times per second a frame is transmitted to a video display screen.
Xenon Arc Lamp	See *Arc Lamp*.